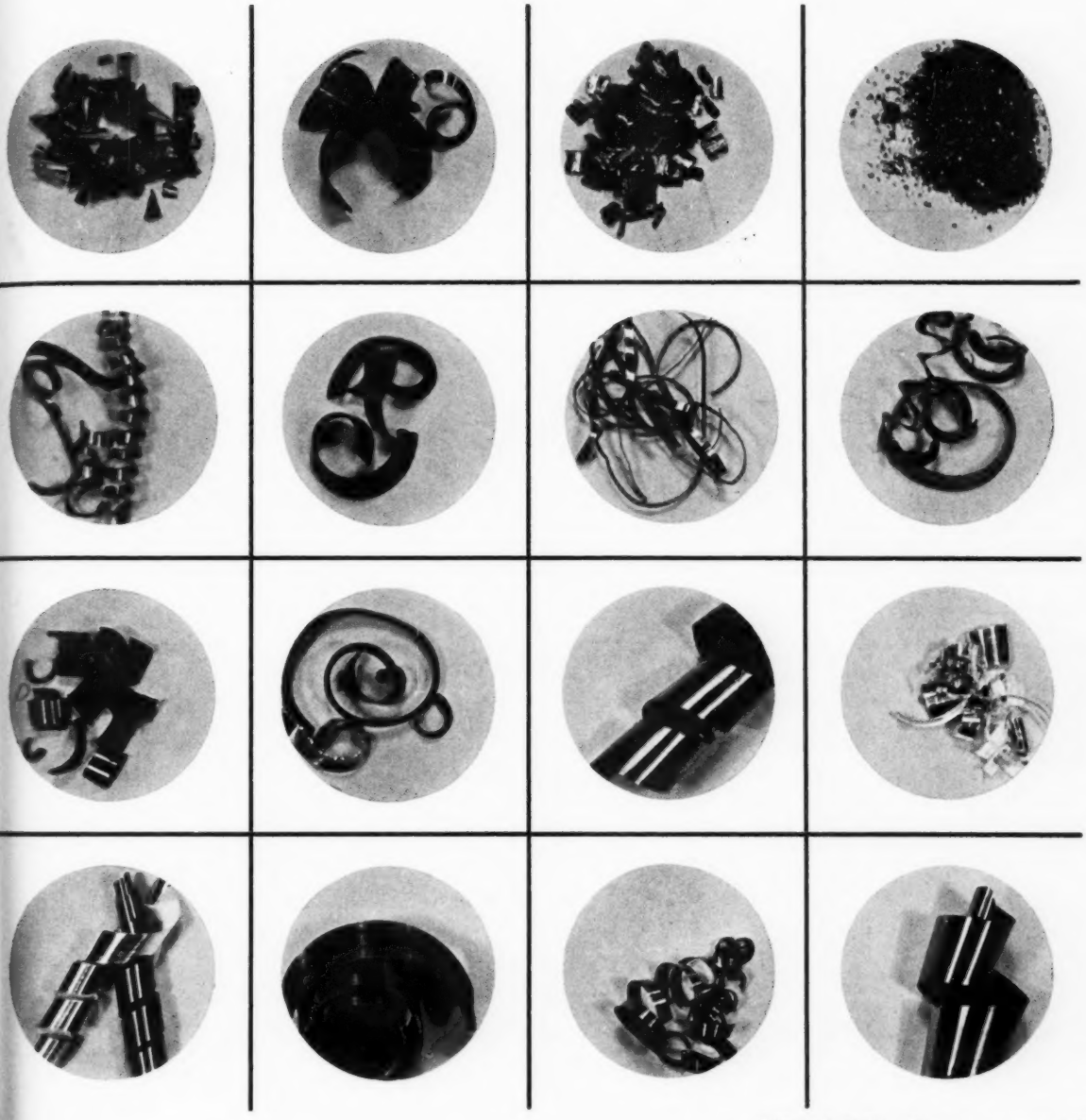
APRIL 1961

TOOLING & PRODUCTION

The Magazine of Metal Working Methods



Chips Tell The Story . . . page 72

Reduce Grinding Costs . . . page 43

Trade-In Your Machines . . . page 56

Machine Replacement . . . page 59

Complete Table of Contents . . . Inside Cover

.0005" tolerances and 32 micro-inch finishes held in tough metals

Holding size and finishes like these is simplified by the smooth running headstock, easy handling and dependable accuracy of the Warner & Swasey No. 4 Turret Lathe.

On the new No. 4 you can expect big reductions in handling time on jobs like these. Each machine in the Warner & Swasey line is individually designed for maximum efficiency and production in its own work range.

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CIRCLE INFORM-A-CRAM KEY NO. 2

TOOLING & PRODUCTION Magazine

VOL. XXVII, No. 1
APRIL 1961

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"personally speaking . . ." **4**
Ray Huebner, Publisher

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TOOLING & PRODUCTION MAGAZINE

Vol. XXVII, No. 1 George J. Huebner, Founder 1885-1956

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CIRCLE INFORM-A-GRAM KEY NO. 4

personally speaking...

Dear T & P Reader:

We have a piece of "must" reading in this issue that has import for every man concerned with production of machined parts. It is the editorial in this issue, and is entitled "Where Have We Fallen Short?" I think it states the case for numerical control as concisely as anyone ever has done it.

Of course, it is true that numerical control still is relatively new. We had reason to look into this matter of availability of numerical control systems and numerically controlled machines and we found, for example, that back in 1955 at the Machine Tool Exposition of that year there were only four or five machines exhibited that were numerically controlled. Many machine tool builders and control manufacturers have been in the act since then, so that in the short period of five years from the 1955 Machine Tool Exposition to the one held in 1960, there was sufficient development that 60 exhibitors in the 1960 show demonstrated around 100 machines that were numerically controlled.

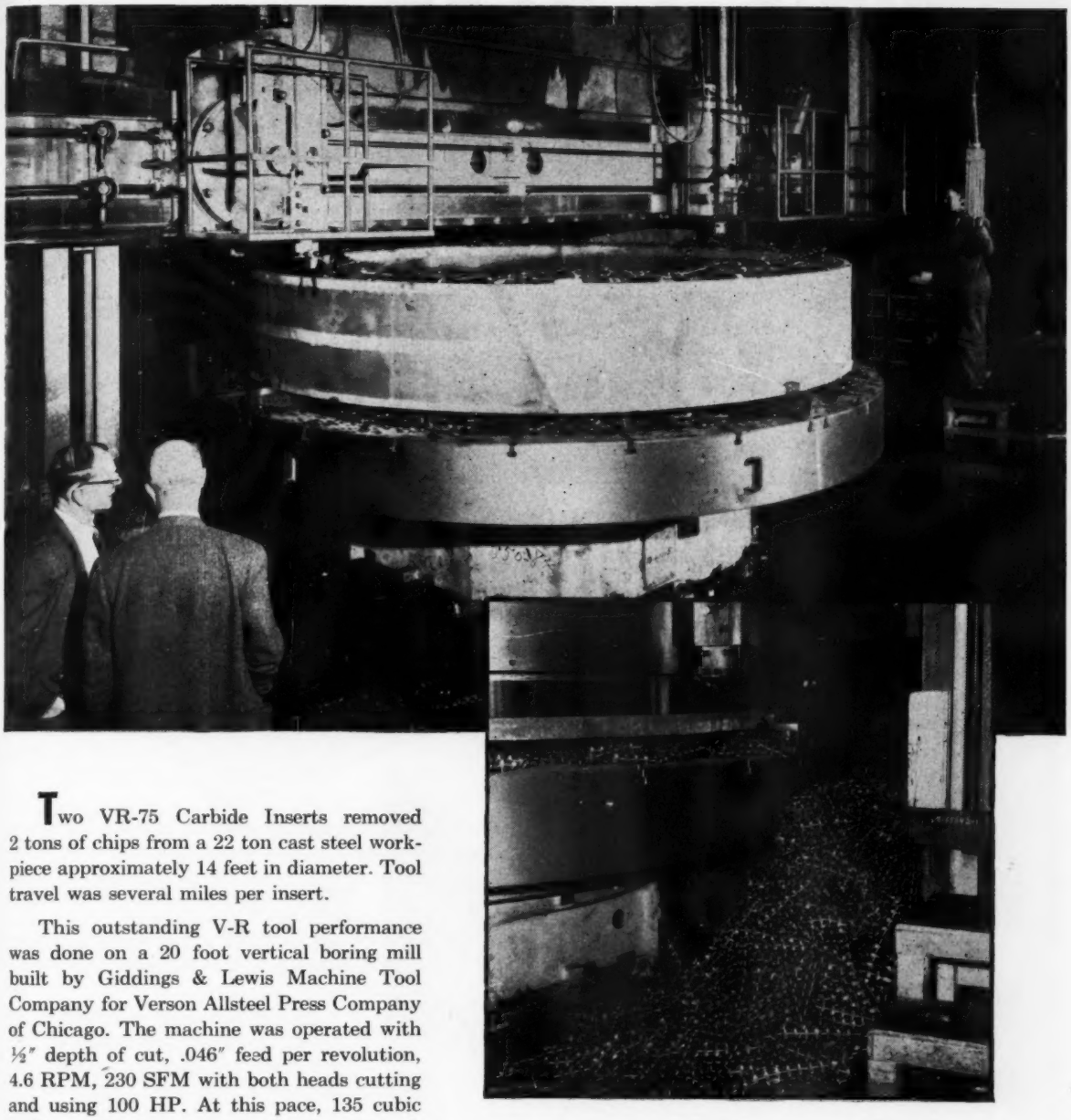
In the January issue, we went to great lengths to try to rationalize on the question of whether retrofitting of old machines could be successful. We published the views of many authorities on the subject in that issue in the form of direct quotations. Actually, it makes little difference how one arrives at the end result of using numerical control. If retrofitting can be successful, the investment may be a little less. But, the additional investment in a complete new machine with numerical control built-in need never stop you if you have pertinent applications for numerically controlled machines. I urge you to read the editorial in this issue and then analyze your own needs. And don't be scared off by the necessity of a large investment because the savings that can be effected are simply enormous.

A well-known machine tool builder just announced a program that can have enormous implications. I'm referring to Pratt & Whitney and its new "any make" machinery trade-in plan. This company is going into the used machinery business to the extent of establishing a separate corporation which will acquire the used machines and will re-condition them and then merchandise them. In a sense, somebody in the machine tool business finally is "taking a leaf from the book" of its biggest customer, the automobile industry. Now that the ice is broken, there will probably be others that will follow suit and this program can easily be the means of aiding you materially in up-dating many of the machine tools in your plant.

Cordially yours,

Ray Hueber

Publisher



Two VR-75 Carbide Inserts removed 2 tons of chips from a 22 ton cast steel workpiece approximately 14 feet in diameter. Tool travel was several miles per insert.

This outstanding V-R tool performance was done on a 20 foot vertical boring mill built by Giddings & Lewis Machine Tool Company for Verson Allsteel Press Company of Chicago. The machine was operated with ½″ depth of cut, .046″ feed per revolution, 4.6 RPM, 230 SFM with both heads cutting and using 100 HP. At this pace, 135 cubic inches of metal were removed per minute. A finishing cut followed using 8 RPM, 360 SFM with .023″ feed per revolution.

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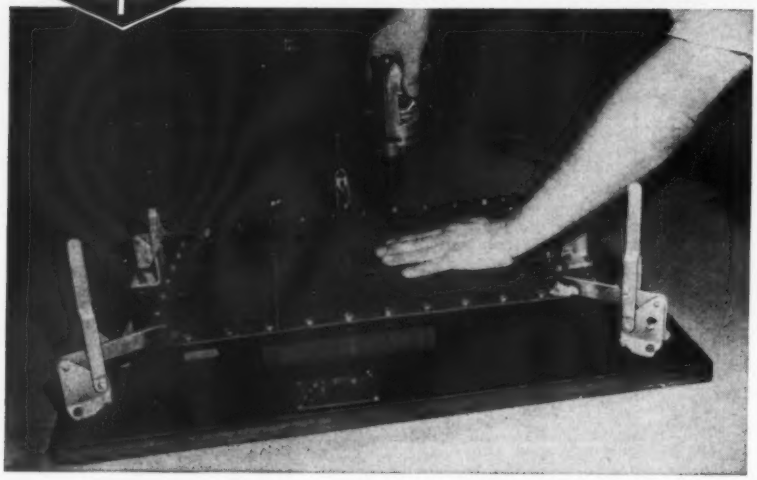

Simple drilling fixture made up of 5 toggle action clamps mounted on a plywood base holds drill bushing plate firmly in position.

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CIRCLE INFORM-A-GRAM KEY NO. 6

Talk of the Month

Don't Murder Your Business!

by Irving Elbaum

Mr. Elbaum is a certified public accountant practicing in Los Angeles, California.

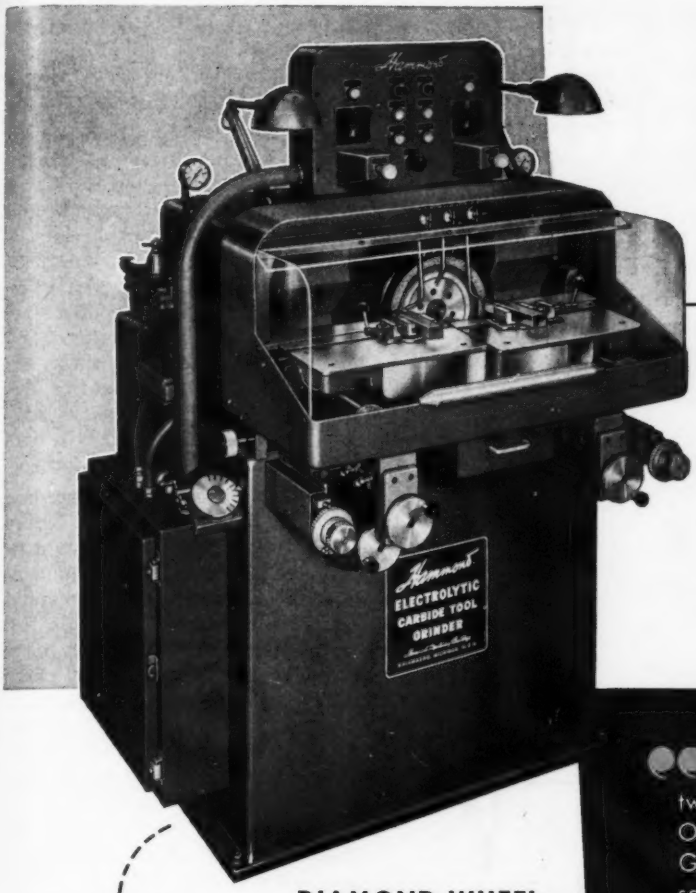
MOST BUSINESSES DO NOT DIE A NATURAL DEATH. Their managements kill them! Whether the business firm is a sole proprietorship, a partnership or a corporation doesn't seem to matter, and there are various murder techniques.

There seems to be a popular misconception regarding the ease with which the life of a metalworking plant can be sustained. Sustaining "life" in any business, is a tough job at best, and is more difficult during certain stages of our economy.

Certain problems are peculiar to small businesses. Such businesses are often not too well capitalized and are not as well controlled as larger operations. They continually face shortages of working capital while operating under tighter credit. Thus the advantages of being small and seemingly easy to control are offset by the disadvantages of inadequate financial reserves.

Let's look at some figures concerning business failure. A survey made by Dun & Bradstreet indicates that only 78 of every 10,000 businesses fail. This is amazing, considering that many new business proprietors have had little or no prior business experience. This statistic was based on a 50 yr period taking in certain periods

. . . **Continued on page 8**



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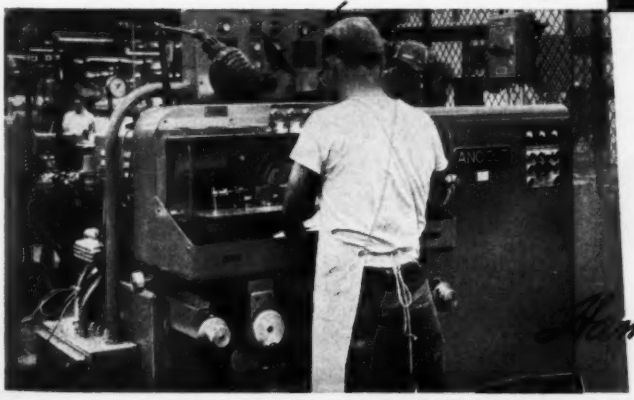
ELECTROLYTIC TOOL GRINDERS

DIAMOND WHEEL COST REDUCED
7 to 1

GRINDING TIME REDUCED
4 to 1

"We are happy to report that our two SCE-10 Hammond Automatic Oscillating 10" Duplex Electrolytic Grinders are producing substantial savings due to the reduction in tool resharpening time and diamond wheel costs.

For example, we are removing .045" of solid carbide in 45 seconds from a tool approximately 1 2" square, processing two tools simultaneously. We are realizing a savings of 7 to 1 in diamond wheel costs, and a reduction in grinding time of approximately 4 to 1."



. . . Another dollars and cents success story for Hammond Electrolytic Grinders! If you, too, are after IMPORTANT savings in carbide tool grinding, take this simple step now: Send us a few single point tools to be ground. They'll be returned promptly with a "processing and time required report." No obligation.

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See us at the ASTME Show, May 22-26, New York Coliseum.

CIRCLE INFORM-A-GRAM KEY NO. 7

. . . **Month's Talk from page 6**

where business mortality was unusually high. This low failure occurred in businesses in existence for 5 yrs or less. It also showed that the number of failures per year is increasing. And even though the failure is not yet at a serious level, diligence and concern are in order.

Just what are the basic reasons for business mortality? A study of 9,162 failures showed the following causes, listed in order of importance: incompetence 42%, lack of business experience 31%, lack of particular experience 14%, neglect 6%, fraud of the owners 4%, miscellaneous 3%.

If we examine each reason, perhaps we can determine a course of action against failure.

Incompetence

Incompetence takes three forms: **economic, emotional** and **physical.** These have overlapping effects. For instance, economic incompetence can soon become emotional and end up as a physical handicap.

Major consideration should be given a situation as to its **economic incompetence** through an appraisal of initial capital needed. The wise man going into business should have calculated his financial needs fairly accurately to keep the business going for at least a year. Unfortunately, too many people start on the proverbial shoestring. They feel that once the initial outlay for machinery, furniture, fixtures, deposits, licenses, merchandise, supplies, etc. is made, things will take care of themselves. This is not true.

It is vitally important to prepare a simple accurate budget before launching a business. It should be complete as to estimated monies needed to acquire the capital equipment, and it should also set forth the amount needed to meet payrolls, overhead, and to carry those customers not on a cash basis. One doesn't need to be a C.P.A. to prepare this simple accounting and it need not take any special form, but it should be done before one embarks into business. I estimate that at least half of all small businesses are started without a financial plan. Failure is not inevitable, yet this simple device is most important, regardless of the magnitude of your starting resources.

Emotional incompetence is one of the more common reasons for business failure. Many men are excellent workers but find they cannot bear up under the responsibility of heading a business.

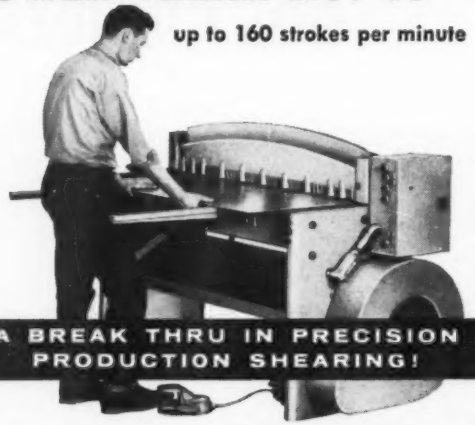
Before going into business, a person should ask the following questions: Am I prepared to lose money? Can I take care of my creditors and employees while getting a start? Will I be able to work long hours and make sacrifices? Do I really like the business I am considering? Do I know enough about the business to handle it successfully?

Physical incompetence is indicated by an individual when he cannot take the heavy work schedule required by many businesses. Antidotes appear to be simple, but many cannot be recognized unless set down. One would be to sell the business. Another would be to

. . . **Continued on page 10**

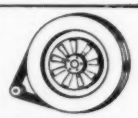
NEW DI-ACRO POWER SHEAR NO. 48

up to 160 strokes per minute

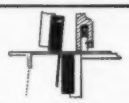


A BREAK THRU IN PRECISION PRODUCTION SHEARING!

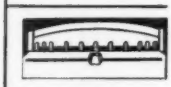
Micrometer operated ball bearing back gauge graduated in .001".



Electric clutch provides instantaneous action.



Inclined ram keeps only blade edge in contact with material.



Spring loaded feet compensate for variations in width and thicknesses of material.

The all new Di-Acro Power Shear No. 48 is a high speed, high production machine. Material capacity is 14 gauge mild steel across a 50 inch blade length. Standard equipment includes a micrometer operated ball bearing back gauge graduated in .001". This back gauge is double bracketed. An optional front operated control includes a counter with direct readings in both inches and thousandths.

The high-torque, high-slip totally enclosed motor of the Shear drives a flywheel with a built-in self-adjusting electric clutch. Triple V-belt drive is quiet, gearless. Because the electric clutch engages instantly without pausing for pins, splines or valves, the No. 48 shears at up to 160 strokes per minute on single cycling . . . ideal for use in conveyor and run-out lines. An adjustable cam operated brake engages only at the top of the stroke—no drag to wear out linings and absorb power.

Inclined ram keeps only the blade edge in contact with the material to be sheared. The angle of the blade counteracts thrust, keeps the blade straight and reduces force needed to shear material. It also permits the use of easy-to-sharpen straight sided blades which can be rotated to use all four edges for shearing.

The hold-down bar operates automatically and acts both as a safety guard and a material clamp. Individually spring loaded feet compensate for variations in material thickness and for shorter than full width sheets.

Standard equipment includes motor, automatic hold-down, micrometer operated back gauge, front gauge bar and brackets, side squaring gauges, reversible protractor gauge, one set of alloy tool steel four-edged blades, and a movable foot trip pedal.

For complete information consult the yellow pages of your phone book under Machinery: Machine Tools for the name of your nearest distributor or write us.

See complete Di-Acro line in Sweet's Machine Tool Catalog

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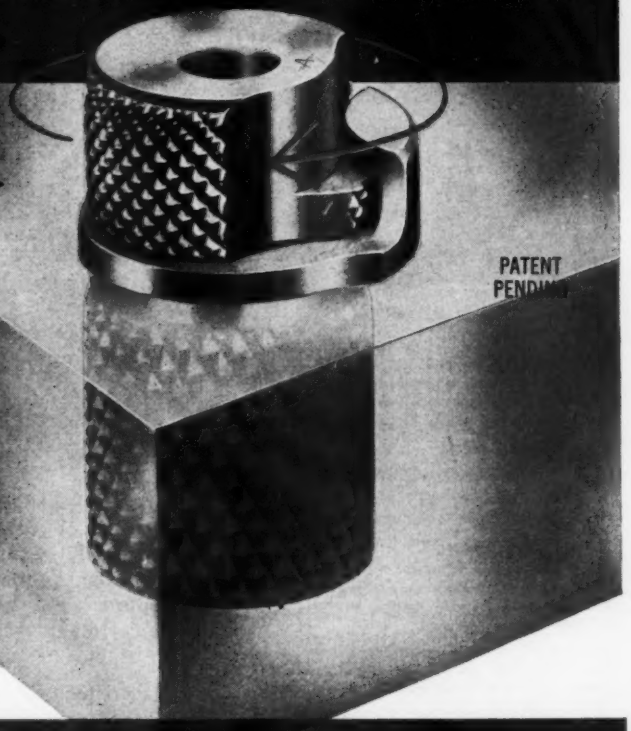

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American's unique Un-A-Lok Delt-A-Liner features a built in locking lug. Permits use of **slip renewable** bushings in plastic tooling — without the problem of locating lockscrews. Makes liner installation easy as potting a bushing. Saves time and labor.

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NEW HAMILTON VARIMATIC® DRILLING MACHINE

2960b

CAPACITY TO 5/16"

Drills to the center of a 10" circle. Head swings radially on column and locks at any position. Vertical adjustment of head on column, 6". Spindle speeds from 840 to 9300 R.P.M. infinitely variable in two ranges. 2½" feed of spindle.

NEW bearings, new castings, new ratios make *this* Varimatic the most accurate, the most rigid we have ever built.

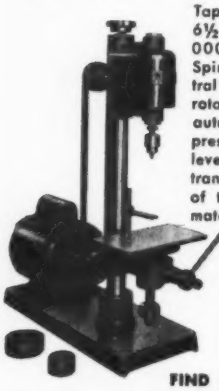
CLEARANCES

Center of chuck to column	5"
Round table to chuck	10"
Rectangular table to chuck	9½"
Base to chuck	14"

This new Varimatic brings a new dimension to **the production drilling of small precision holes.** See it at your dealer's show room.

COMPANION TAPPER

also Super Sensitive and Precise



Taps to the center of a 6½" circle. Capacity, 000-120 to 10-24. Spindle returns to neutral position and stops rotation instantly and automatically when pressure on the feed lever is released. Entrance and withdrawal of tap is *gentle*. Thin materials are tapped without stripping. Brittle materials without chipping. Blind holes without tap breakage.

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Our Bulletin No. T/2960 illustrates and describes the Hamilton Super Sensitive Tapping Machine in full. Shows features by means of a sectional engineering drawing. It's free, too. Write for it today.

If you would like the complete Varimatic story . . . with pictures, and a sectional engineering drawing . . . write for our FREE Bulletin No. V/2960.

THE HAMILTON TOOL COMPANY

832 SOUTH NINTH STREET
HAMILTON, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 10

. . . Month's Talk from page 8

transfer some of the demanding duties to an employee, if a dependable one can be found. You might help the situation by renting or buying labor-saving devices, or you can enlist outside help.

Lack of Business Experience

Typical symptoms of business illness from lack of experience are: 1) no records or inadequate records, 2) over-extension of credit, 3) poor collections, 4) too large a fixed overhead, 5) failure to reduce variable overhead when going gets rough, 6) overbuying or underbuying, 7) poor location of business, 8) not knowing the competition.

Lack of Well Rounded Experience

This is often reflected in favoring one department to the neglect of the others. Former salesmen are the greatest violators. Accustomed to seeing business through the eyes of a salesman, they find it hard to place purchasing, credits, collection, etc., in their proper relation to the other business procedures.

Where a partnership exists, the problem of well rounded experience is not as acute. Each partner's varied experience contributes and acts as a sounding board for his counterpart.

The accountant, with his diversified experience, can be a good advisor. In the last analysis his "financial statement" will highlight significant distortions due to misplaced emphasis and effort.

Another way to offset the lack of diversified experience is to draw on the experience of others in your industry. Read trade publications, attend industry conferences, and maintain memberships in trade associations.

Neglect

This is generally due to: 1) poor personal habits, 2) poor health, and 3) domestic difficulties. These drawbacks are often the most difficult, and sometimes impossible to cope with. The proprietor has to be aware of these difficulties, and make the decisions as to whether they are surmountable or not. If they are not able to be overcome, it might be wise to sell the business—before it is lost. In instances where there is a temporary health problem, management could be turned over to a trusted employee or close relative, or a manager could be hired.

Fraud of the Owners

Few businesses fail because of fraud. There are many ways it is done, like false financial statements, illegal disposition of assets, deliberate overbuying, etc. But little can be done since those practices are usually uncovered after the fact, and the business is too far gone to salvage.

Miscellaneous

Such items as employee fraud, disasters and all other reasons for business failure fall into this miscellaneous category. Employee fraud, fire, burglary, boiler explosion, etc., can be protected against by insurance. The advice of an insurance broker can be invaluable at the inception of a business. This is also true on a continuing basis, since a business is a dynamic thing. Even a very small business requires an insurance review every month or so.

Awareness of the causes of failure can go a long way toward preventing the event, but action is also necessary. The following checklist will give you action-ideas to help keep your business alive:

1) Join trade associations.

2) Read trade journals.

3) Question suppliers and salesmen about new developments.

4) Talk to attorneys, accountants, bankers and insurance men.

5) Discuss all phases of business with your most able employees.

6) See your doctor if you are chronically ill.

7) Keep accurate records.

8) Review your accounts receivable regularly.

9) Analyze financial statements thoroughly. end

NEW HAMILTON VARIMATIC® SUPER SENSITIVE DRILLING MACHINE

The NEW Hamilton Varimatic, Super Sensitive, Variable Speed, Small Hole, Precision Drilling Machine is, by far, the smoothest Varimatic we have ever built. It has fewer parts, is subject to less wear, and requires less maintenance than ever before. Tolerances have been tightened. Working clearances have been increased. It offers flexibility and sensitivity, accuracy and stamina far beyond the requirements of the average user.

Some specifications are given in the one column ad on the facing page.

THE HAMILTON TOOL COMPANY

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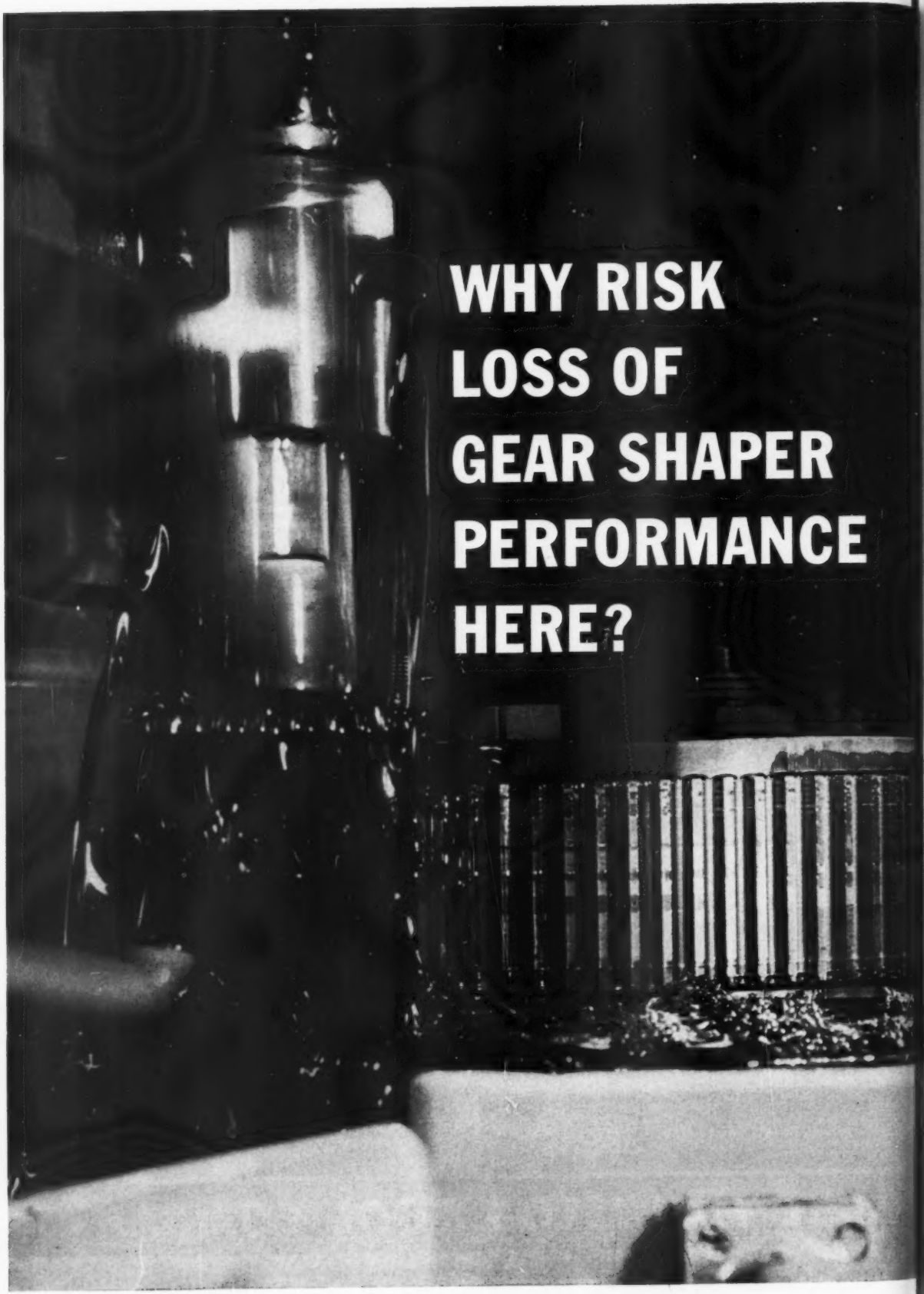
CIRCLE INFORM-A-GRAM KEY NO. 11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LOSS OF
GEAR SHAPER
PERFORMANCE
HERE?

Give your products all the high-production, high precision advantages of Fellows Gear Shaper performance by tooling up with Fellows cutters.

The better design of Fellows cutters is the result of advanced engineering techniques, including the use of a high-speed computer for solving design and application problems. Their better quality is the result of constant advances in metallurgy and manufacturing methods. And, proof of their better performance are the thousands of Fellows cutters in use on modern gear production lines.

Fellows cutters on Fellows machines lower costs and speed production on external and internal, spur and helical involute gears and a wide variety of non-involute shapes as well. All Fellows Offices are at your service for providing information.

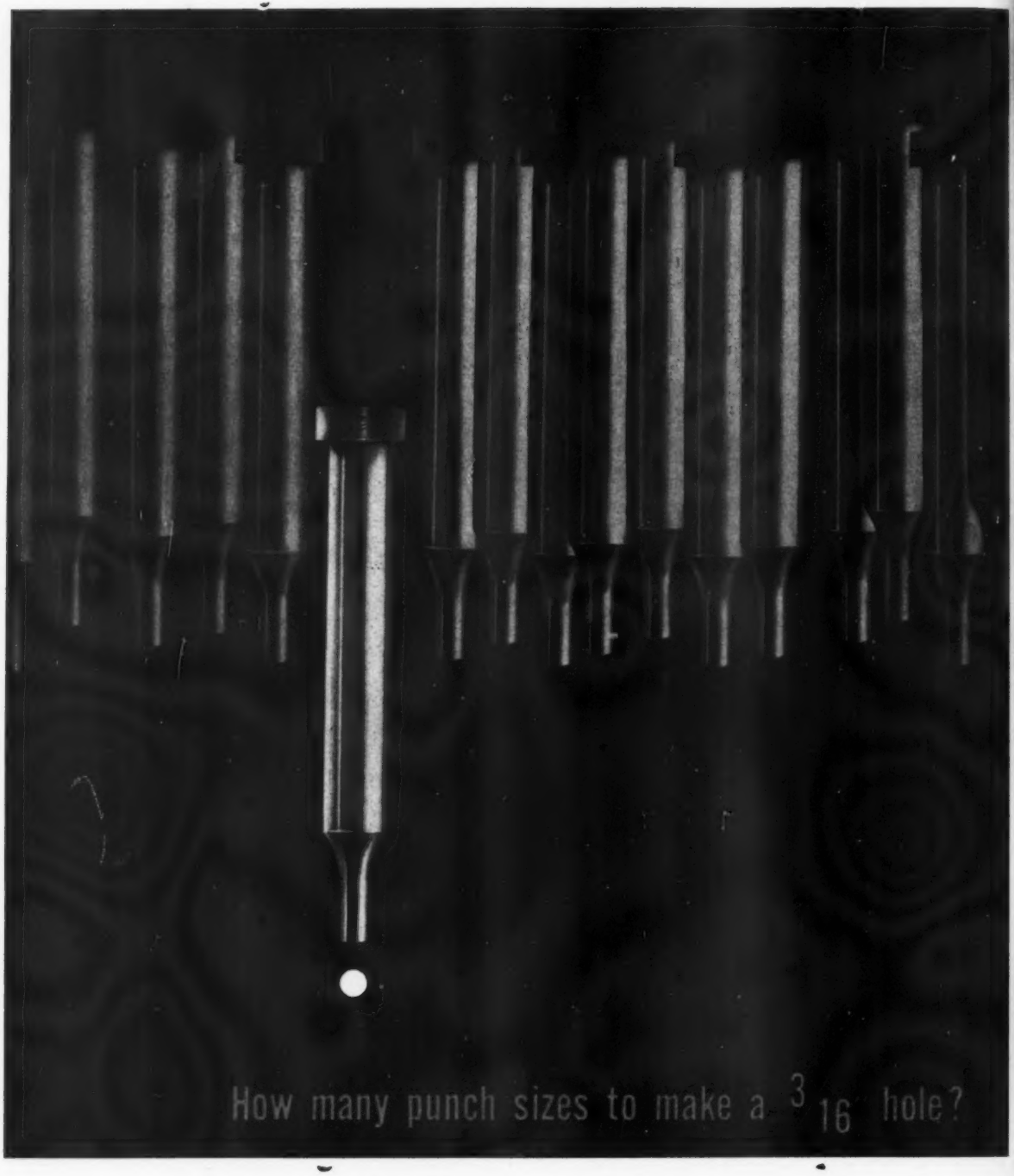
THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont, U.S.A.
Branch Offices:
1048 North Woodward Ave., Royal Oak, Mich.
150 West Pleasant Ave., Maywood, N. J.
5835 West North Avenue, Chicago 39
6214 West Manchester Ave., Los Angeles 45

THE PRECISION LINE

Fellows

Gear Production Equipment

CIRCLE INFORM-A-GRAM KEY NO. 13



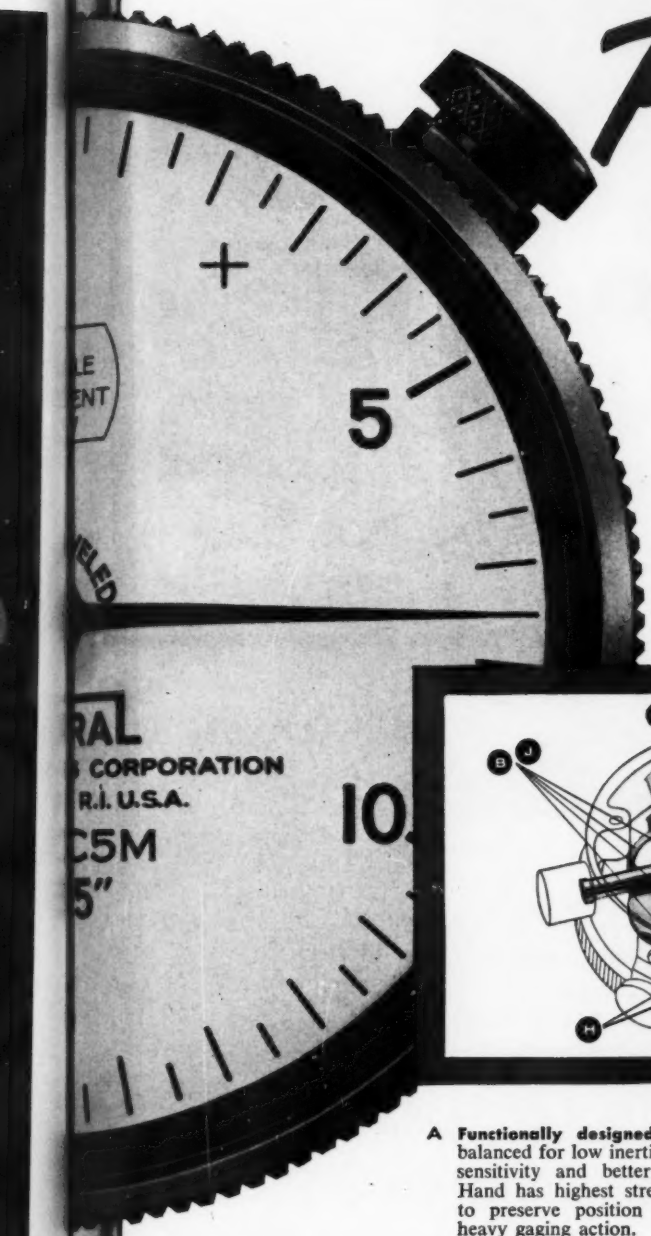
Answer: Just one P.U.P.S.—and that's real economy! ◦ Lower initial cost ◦ Shelf stocking, no costly replacement delays ◦ Cut inventory costs and wasted space by as much as 87% ◦ Replaces 22 or more custom punch point sizes ◦ Complete interchangeability, A.S.T.M.E. standard ◦ Provides common set of punch standards to avoid confusion. Your Dayton Perforators Distributor has the inside money-saving P.U.P.S. story. Contact him today, or write to:

CIRCLE INFORM-A-GRAM KEY NO. 14

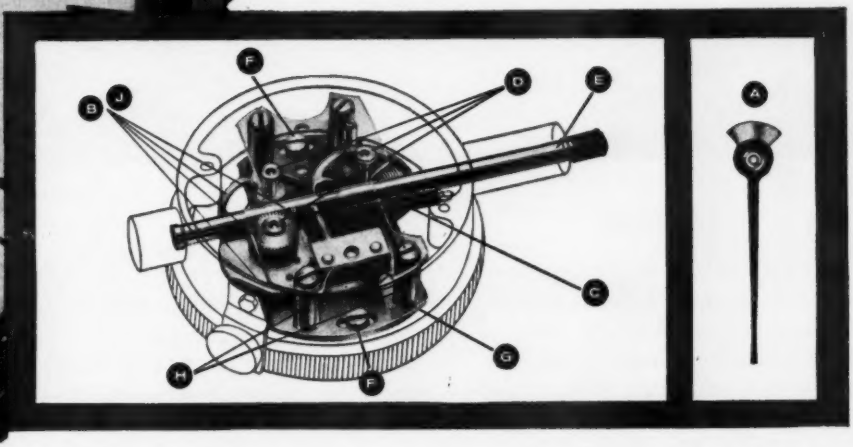
PUPS
PROVEN USAGE PUNCH SIZES

Dayton Perforators, Inc.
1336 Stanley Avenue • Dayton 4, Ohio
Phone BAldwin 3-9944 • TWX DY-339

You get all these *Plus Features* only in Federal Indicators



Full Jeweled Bearings, Unit Construction, Low Inertia Indicating Hand, Miracle Movement — each of these advancements pioneered by Federal has a particular significance to you in terms of better performance. AND, with all these *plus* features, Federal Dial Indicators generally sell for LESS due to their wide acceptance which has made possible the economies of quantity production. Here are the features and reasons why they are important:



A **Functionally designed Indicating Hand** balanced for low inertia, provides greater sensitivity and better repeat accuracy. Hand has highest strength-to-mass ratio to preserve position and shape under heavy gaging action.

B **Precision-made, Stainless Steel Gears, Rack and Pinion,** for a rustproof, smoother running, more accurate movement.

C **Positive Contact** with minimum pressure for faithful indicator response.

D **Full Jeweled Bearings** reduce friction, for improved accuracy over a longer period of time.

E **Precision Fit** of spindle and bearing for better repeat accuracy.

F **Accurate Movement Positioning** for optimum rack and gear alignment. Provides extremely close and positive control over a critical fit in *every* indicator.

G **Unit Construction** for easy maintenance and adjustment.

H **Rigid Assembly** of top and bottom plates for accurate gear alignment essential to minimum wear.

J **Gear and Rack Teeth** are hobbed with micro precision so that each Federal Indicator provides uniformly high accuracy throughout its *full* range.

MIRACLE MOVEMENT

For complete story on Miracle Movement, write . . .

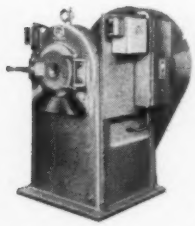
FEDERAL PRODUCTS CORPORATION • 1234 EDDY STREET • PROVIDENCE 1, R. I.

Ask FEDERAL *First*

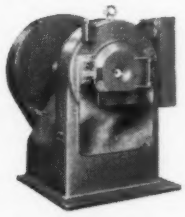
for recommendations in modern gages . . .

Dial Indicating • Air • Electric, or Electronic — for inspecting, measuring, sorting, or automation Gaging

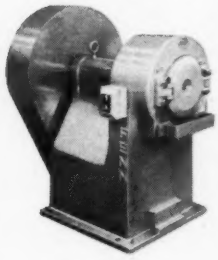
CIRCLE INFORM-A-GRAM KEY NO. 15



Rotary Two-Die

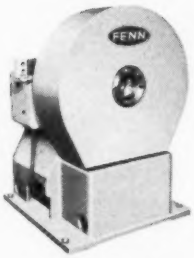


Rotary Four-Die



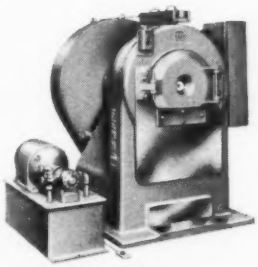
Long Die

Cost conscious manufacturers are finding it extremely profitable to design the components of new products . . . or redesign old ones . . . for production on Fenn swaging machines. What's more, in many cases swaging makes it better. On the *money saving* side, here are important considerations. Low investments in both machines and dies, the absence of chips with resulting savings in both metal and chip handling, lower labor costs because highly skilled operators are not required, and savings in time . . . for swaging is simple in operation, whether manually or mechanically fed. On *making it better*, swaging improves the physical characteristics of the metal, imparts a high finish, maintains continuous accuracy to within ±.001", and performs many operations possible by no other method. Your nearest Fenn sales engineer can competently advise you on possible application to your product.



Stationary Die

For complete guide to rotary swaging and technical data on the Fenn line, write for Catalog SM-60. The Fenn Manufacturing Company, Fenn Road, Newington, Connecticut.



Hydroformer

Only FENN makes all types of swaging machines

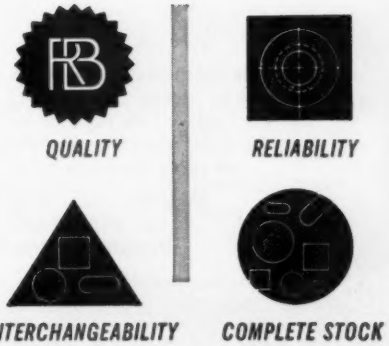
CIRCLE INFORM-A-GRAM KEY NO. 16

WHATEVER SHAPE YOU NEED IN A PUNCH OR DIE BUTTON,
Richard Brothers can supply it

More than 10,000 sizes and types of standard punches and die buttons are immediately available from Richard Brothers' existing stock.

But that's just the beginning. Richard Brothers will also make any special-shaped punch or die button to your exact specifications . . . will fabricate them from special alloys, if you wish. All R-B punches and die buttons . . . standard and special . . . incorporate standardized R-B features which offer complete interchangeability.

Do business with the leader. Specify R-B punches and related metal-piercing tools. It pays . . . many ways.



RICHARD BROTHERS PUNCH DIVISION

ALLIED PRODUCTS CORPORATION
DEPT. G5 • 26500 CAPITOL AVENUE • DETROIT 39, MICHIGAN

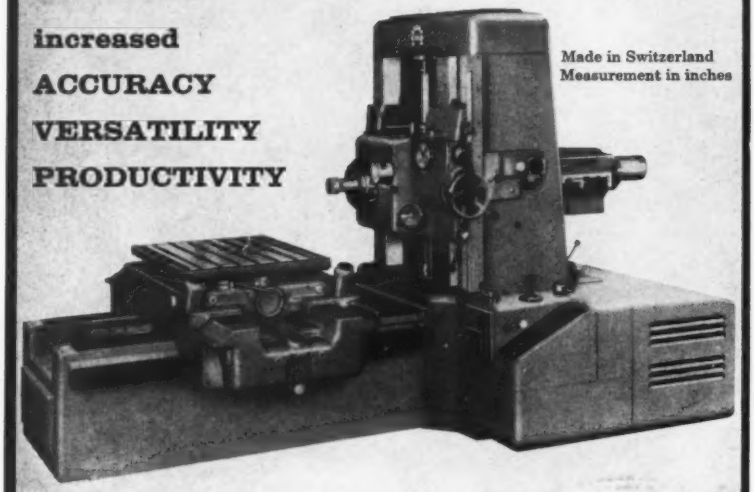
CIRCLE INFORM-A-GRAM KEY NO. 17

CUT ACCUMULATED ERRORS to a minimum

with the

DIXI 75 horizontal optical jig borer

increased
ACCURACY
VERSATILITY
PRODUCTIVITY



Made in Switzerland
Measurement in inches

- Automatic positioning can be changed instantly to manual operation
- Projected optical setting—direct reading to .00005" for linear motions and 1 sec. of arc for built-in rotary table. Linear optics provided with adjustable zero reference
- Simplified controls functionally arranged for greater operating speed and efficiency
- 3" diameter boring spindle
- Increased capacity: table size 39⅜"x32"; 29⅝" cross travel; 23⅝" longitudinal travel; 25⅝" vertical travel
- Hydraulic feeds and infinitely variable spindle speeds
- Rear support optional

MBI has engineers available for consultation, guarantees service by factory trained staff, and stocks spare parts in New York.—Join the long list of leading aircraft and manufacturing plants throughout the United States which are using the horizontal optical jig borer.

Demonstrations upon request at our conveniently located demonstration centers.

MBI

M. B. I. EXPORT & IMPORT LTD.
A DIVISION OF MACHINERY BUILDERS, INC.
475 Grand Concourse, Bronx 51, N. Y.
Swiss Accuracy plus U. S. Know-how

CIRCLE INFORM-A-GRAM KEY NO. 18

Industrial Fair

The Hanover Industrial Fair will be held from April 30-May 9, 1961 to give an international cross-secton of everything in industry throughout the world.

Being a manufacturers' Fair, Hanover provides a unique opportunity for talks with the top executives as well as with the engineering and sales personnel of exhibiting companies. Five thousand firms from 25 non-German industrial countries, are exhibiting. Machines and equipment are to be shown in operation. For more information write the German American Chamber of Commerce, Inc., 666 Fifth Ave., New York 19, New York.

Welding Convention

The American Welding Society will hold its 42nd Annual Convention and Welding Exposition and act as host to the International Institute of Welding, in New York, April 10-21, 1961. The I.I.W. will meet April 10-15 at its headquarters hotel, the Sheraton-Atlantic, Broadway and 34th St., and remain for the AWS Meeting and Welding Show which will take place the following week. For further details write to the Information Center, American Welding Society, 33 West 39th St., New York 18, New York.

Metals Engineering Conference

The American Society of Mechanical Engineers, meeting at the Penn Sheraton Hotel, Pittsburgh, Pa., will hold a Metals Engineering Conference April 23-26.

For further information write ASME Meetings Dept., 29 West 39th St., New York 18, N.Y.

Management Conference

The American Society of Mechanical Engineers will meet for a Management Engineering Conference April 6-7. Headquarters will be the Hotel Statler Hilton, New York.

For further information write ASME Meetings Dept., 29 West 39th St., New York 18, N.Y.

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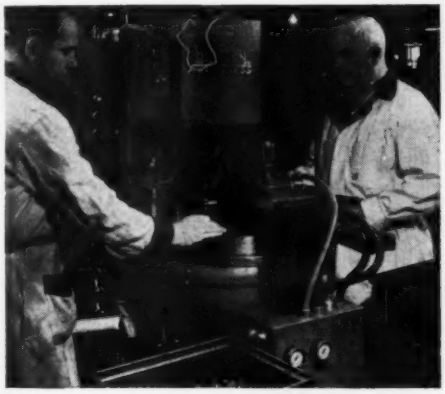
DENISON HydrOILics

How **STEWART-WARNER** produces 220 different assemblies on one **DENISON** Multipress and saves...

MONEY



THIS NEW SERIES "R" MULTIPRESS *assembles 220 different assemblies and prepares them for brazing at Stewart-Warner Corp., Chicago. Write for free Bulletin 324—New "R-S-T" Series Multipress.*

COST-SAVING versatility was a key requirement on this pressing job. To produce assemblies for a new product line, Stewart-Warner's Alemite Division needed a press set-up that could handle up to 220 different assemblies. And because of the short runs involved, fast changeover with minimum downtime was a must. *Installation of just one Denison hydraulic Multipress filled the bill.*

This Denison Series "R" 6-ton bench press, equipped with automatic index table and special "quick-change" tooling, assembles from 600 to 850 assemblies per hour. Finished parts are uniform, high-quality ... *no rejects.* And tooling changes can be made in minutes to accommodate the full range of 220 different types and sizes.

A unique feature of this operation is an adjustable applicator mounted on the index table that automatically applies a metered amount of brazing compound to each two-piece assembly. It completely eliminates a former hand operation—*and does the job better.*

What's *your* problem? Ask the nearby Denison Production Specialist about a **M**ultipress **A**nalysis **P**rogram in your plant now. It can **MAP** new ways to cut your costs, get better quality finished products.

DENISON ENGINEERING DIVISION
American Brake Shoe Company
1197 Dublin Road • Columbus 16, Ohio

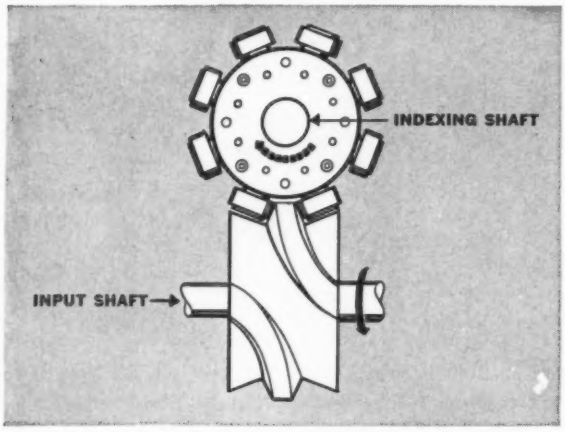
HYDRAULIC PRESSES
PUMPS • MOTORS • CONTROLS

DENISON
HYDRAULIC MULTIPRESS

CIRCLE INFORM-A-GRAM KEY NO. 19

How Ferguson *ELIMINATES BACKLASH* in Index Tables

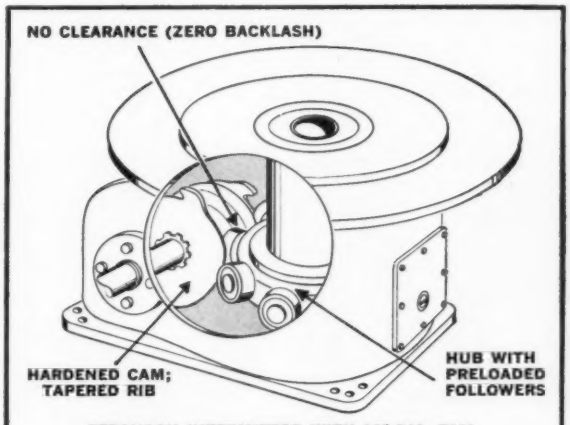
Backlash in indexing results in shock loads that affect the efficiency of a machine and the quality of its product. Most indexing mechanisms have inherent characteristics that cause backlash and poor dynamic conditions and prevent the designer from taking full advantage of modern feeds, tooling and methods that contribute to production economy.



Ferguson Intermittor Index Tables have inherent zero backlash and extreme precision which results in a rotary transfer machine base capable of operating speeds up to 500 indexes a minute. *A Ferguson index table never proves to be a limiting factor in the speed or performance of an automatic assembly machine.*

HERE'S WHY: The continuously rotating cam of a Ferguson indexing mechanism features a *tapered rib* along which two preloaded bearing followers roll, maintaining constant contact with no clearance between them and the rib. When the mechanism is in the rest, or dwell, position, a straight portion of the rib locks the followers with zero backlash and an indexing accuracy of .001". Wear on the hardened tool steel cam is infinitesimal (many have been in use for more than 25 years). Followers are rated for a minimum of 8,000 hours operation. If backlash occurs after this period the life of the drive may be renewed merely by replacing the standard followers.

NOTE HOW PRELOADED FOLLOWERS ENGAGE RIB



FERGUSON INTERMITTOR WITH 12" DIA. DIAL

Compare this with other types of indexing devices. A geneva drive, with its slotted wheel and driver, and a barrel cam with a grooved track which engages one follower at a time, must have clearance in the slot or groove to allow passage of the follower. The slightest amount of clearance causes backlash. As the slot or groove wears, the clearance becomes greater and the backlash condition worsens. At the higher, more profitable operating speeds poor dynamics cause wear on other parts of the machine. The user must choose between frequent downtime for repairs or slower speeds . . . He is the loser in either case.

FREE DESIGN DATA — Load ratings, dimensions and application and installation information about standard and stock Intermittors, Ferguson Drives and in-line machines are contained in a single 36 page catalog. Every designer should have one in his library . . . Write Ferguson—Ask for Catalog No. 160.

FERGUSON
MACHINE COMPANY
A Division of Universal Match Corporation
7818 Maplewood Court • St. Louis 17, Missouri

CIRCLE INFORM-A-GRAM KEY NO. 20

High Cost Second Operations Waste First Operation Profits

But secondary operations can be a big untapped profit source

A case in point: At Kalamazoo Die Casting, a second operation of deburring three critical points in a phonograph pickup arm took three operators (two women and a man) one hour to deburr 350 parts. An ingenious methods man at the plant designed the unit shown above. It is built around three Bellows Air Motors®, a Bellows Air Vise and Bellows control units. Now one girl handles the three deburring operations at a rate of 425 parts per hour.

Give a thought to the possibility that high cost second operations are killing first operation profits. There may be cost saving opportunities you've overlooked. If any one of your second operations involves hand feeding of parts or tools, hand clamping, or manual pull, push, lift or turn motions Bellows-Valvair can save you money.

Write for the SPOT-A-MATION IDEA FILE and BULLETIN BM-25. No obligation. Address Dept. TP-461, Bellows-Valvair, Akron 9, Ohio.

Bellows-Valvair

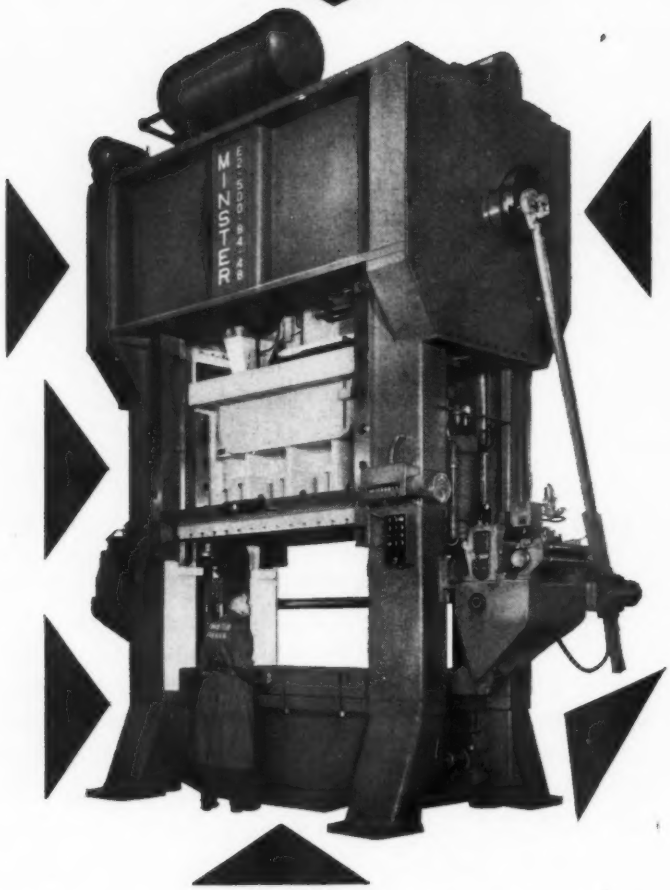
AKRON 9, OHIO

DIVISION OF INTERNATIONAL BASIC ECONOMY CORPORATION (IBEC)

1002-C

CIRCLE INFORM-A-GRAM KEY NO. 21

HIDDEN STRENGTHS and VALUES

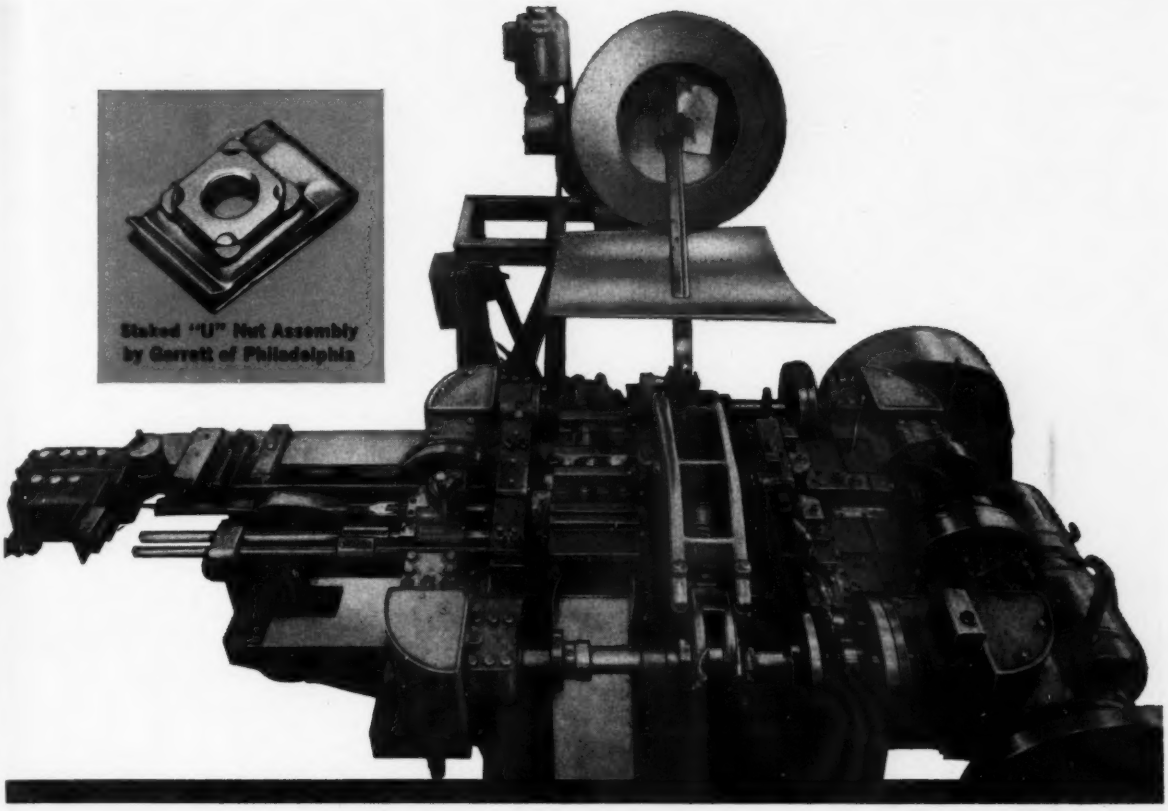


There are many points of superiority in a Minster E-2 Heavy Duty Blanking and Progressive Die press . . . most of which are not immediately obvious at a glance. You might call them "hidden strengths and values." For example, the speed possibilities, the full eccentric shaft . . . the unique frame design.

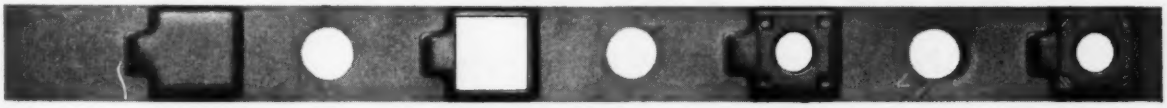
If you buy with an eye to better all around performance, take a close look at the Minster E-2. 200 to 800 tons.
The Minster Machine Company, Minster, Ohio

MINSTER®

CIRCLE INFORM-A-GRAM KEY NO. 22



U.S. symmetrical Multi-Slide® produces staked "U" nut assemblies in one operation!



The No. 33 U. S. Symmetrical Multi-Slide shown above—one of the many in use by The George K. Garrett Company, Inc., of Philadelphia, is producing Garrett's Staked "U" Nut Assembly. Conventional production of this assembly requires 3 separate operations... stamping of blank, assembling and staking before forming, and finish forming.

Now, with the U. S. No. 33 Symmetrical Multi-Slide, the 3 operations are combined and performed by this one U. S. Multi-Slide—which produces complete, Staked "U" Nut Assemblies at the rate of 140 per minute.

This is another example of the cost reduction and time saving advantages U. S. Multi-Slides can and do make possible.

Write for full information on U. S. Multi-Slides —ask for Bulletin No. 15. P

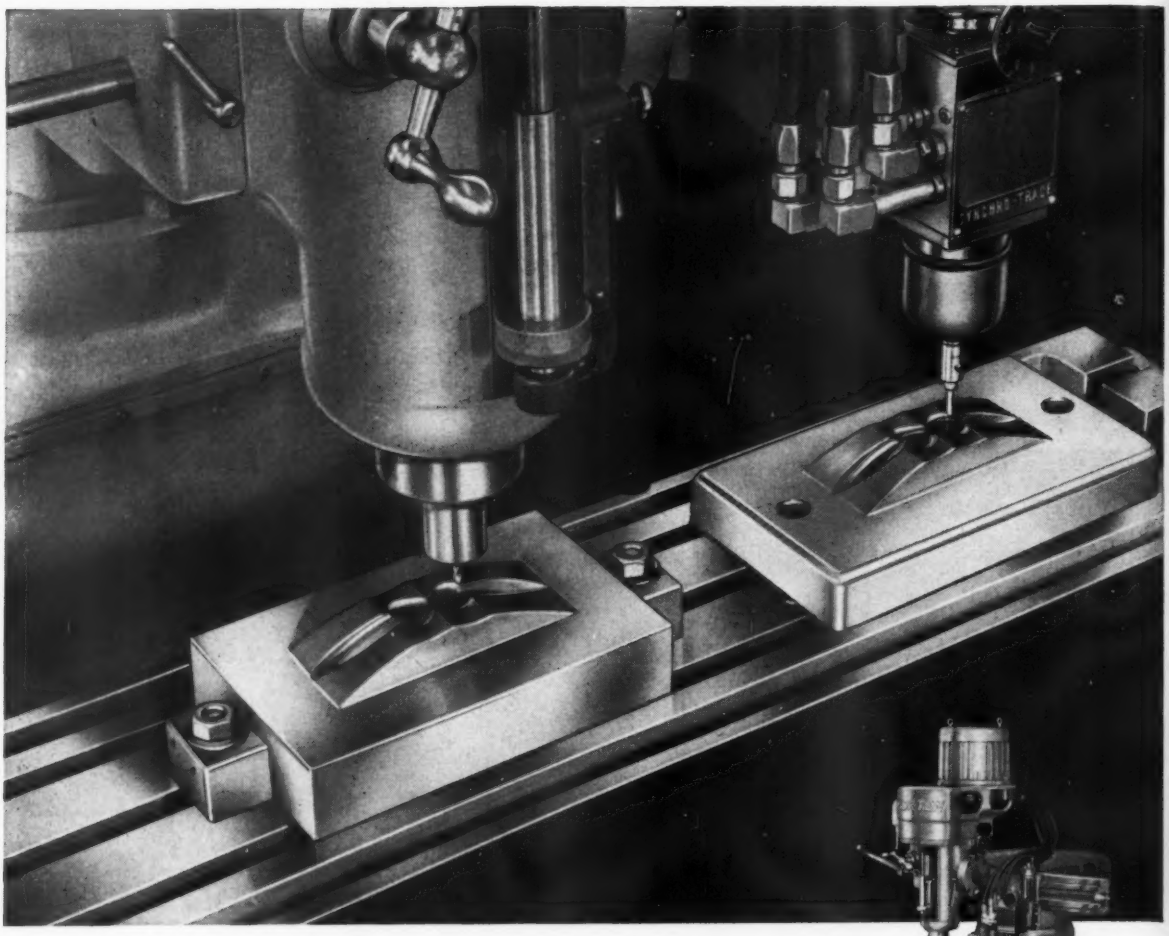
MULTI-SLIDE

U.S. TOOL COMPANY, INC.

AMPERE (East Orange) NEW JERSEY

U. S. Multi-Slides® • U. S. Multi-Millers® • U. S. Automatic Press Room Equipment • U. S. Die Sets and Accessories

CIRCLE INFORM-A-GRAM KEY NO. 23

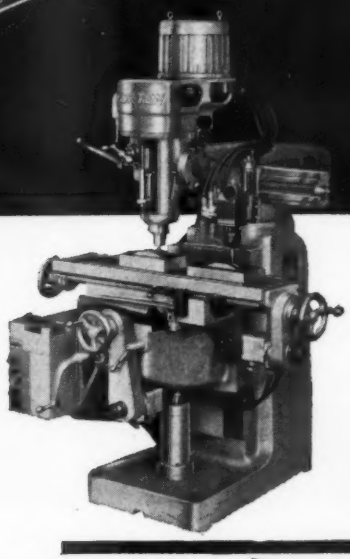


NEW AUTOMATIC DUPLICATOR

GORTON

Synchro-Trace Mastermil

Now . . . in response to metal-working needs, Gorton presents a fully automatic rise and fall duplicator, ideal for all types of dies and molds in ferrous and non-ferrous materials. Sensitivity and accuracy are combined in this rugged milling machine with versatility for power feed and hand feed milling operations . . . a duplicator to provide you with the simplest, fastest, most accurate way to make dies and molds.



Write for Bulletin 3095 for full particulars on Gorton Mastermil with Integrated Synchro-Trace or Contact Gorton Distrbutor in your area.

A GORTON PRODUCT, THE FINEST OF ITS KIND!

GORTON

SINCE 1893

GEORGE GORTON MACHINE CO.

1204 RACINE STREET RACINE, WISCONSIN

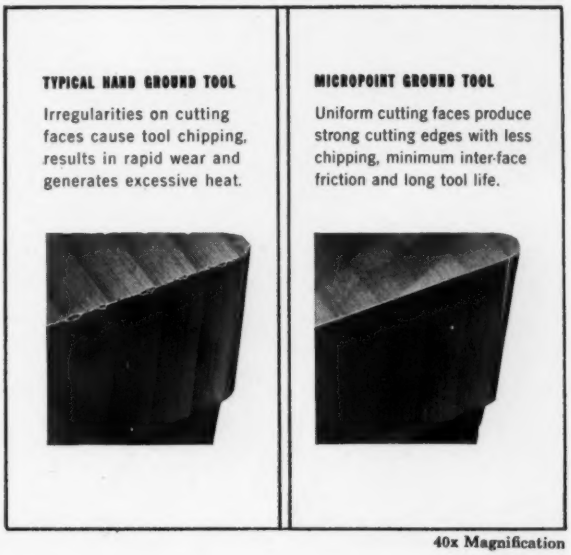
Milling, Die Sinking, Profiling and Engraving Machines with Manual Hydraulic, Electro-Hydraulic or Numerical Guidance Systems. Special Machines and Automated Transfer or Indexing Machines. Cutting Tools and accessories...Defense and special products.

CIRCLE INFORM-A-GRAM KEY NO. 24

special report from Fair Street on cutting tool geometry

ONE OF A SERIES

how quality of the cutting edge drastically affects single point tool life, part size and surface finish


TYPICAL HAND GROUND TOOL
Irregularities on cutting faces cause tool chipping, results in rapid wear and generates excessive heat.
MICROPOINT GROUND TOOL
Uniform cutting faces produce strong cutting edges with less chipping, minimum inter-face friction and long tool life.

40x Magnification

MICROPOINT ASSURES SMOOTH SURFACE FINISH AND STRONG, EVEN CUTTING EDGE

Well over 90% of the power expended in a single point cutting tool operation goes into heat.

To combat the effects of this heat, almost all new cutting tool developments have been directed toward higher resistance to, or better control of, thermal conditions. The goal is longer tool life at higher speeds and feeds, more effective machine tool utilization.

One of the biggest factors in the generation of excessive heat is opposition to chip flow because of interface friction. Also a major factor in the generation of excessive heat is the serrated cutting edge often found at the junction of the top face and relief face of the cutting tool. This uneven cutting edge (note illustration) is the direct result of improperly ground finishes on the top and side faces of the cutting tool.

PEAKS AND VALLEYS RUIN THE TOOL

One look at the uneven cutting edge and it is quickly apparent that under normal machining conditions, the peaks will soon break off, dulling the cutting edge, erasing the vital relief angle, generating more heat with every revolution and soon ending the useful life of the tool. An uneven cutting edge not only shortens tool life, it also has a drastic effect on part size and surface finish. As emphasized in a previous report in this series, loss of relief angle causes excessive down time for a tool change.

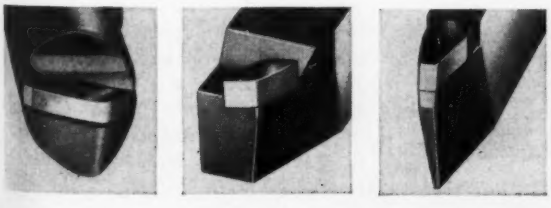
Further study of the illustration will show that there are two basic elements that must be carefully controlled on the cutting edges of a single point tool. First, the top and side faces must be as smooth as possible. Second, the junction of these two faces must be uniform and even. There can be no fragile peaks and valleys to become broken.

To control the quality of surface finish and all other variables that determine a properly ground tool demands a machine capable of great precision. The DeVlieg MICROPOINT Tool Grinder is just such a machine.

MICROPOINT FINELY DESIGNED, RUGGEDLY CONSTRUCTED

MICROPOINT'S design and construction features such as rugged cast iron base, hardened, ground and lapped cylindrical guide ways, and direct drive motor spindle balanced to extremely close tolerances are unique in a single point tool grinder. Cushioned stroke oscillation of the hand operated tool holder is another MICROPOINT innovation. As a result of these features, a standard, fine grit diamond wheel can be used for stock removal and at the same time will provide a surface finish that is almost lapped. These are the features needed on an accurate single point tool grinder in order to get the most out of today's high speed, multiple operation machine tools.

For further information about the DeVlieg MICROPOINT Tool Grinder, please write or visit DeVlieg Machine Company, Fair Street, Royal Oak, Michigan.



DeVlieg

MICROPOINT® TOOL GRINDER

for grinding all sizes and types of round and square shanked tools

CIRCLE INFORM-A-GRAM KEY NO. 25

Check SPECIALS Easily with This New Universal Staging Fixture

There's a new Universal Staging Fixture to position just about *any* part up to 3 inches in length. Mount the part and see the sharp image on the distortion-free 10-inch screen.

So easy, unskilled help can learn it in less than half a day. Other big savings, too . . . extremely low purchase price, *plus* almost unlimited versatility. With your choice of understage and surface illumination, and the new Universal Staging Fixtures, you can just about write off special jigs and fixtures as a cost factor.

Find out more about how B&L can simplify your precision inspection. There's a complete line of instruments to help you. Mail the coupon now.

BAUSCH & LOMB INCORPORATED
79716 Bausch St., Rochester 2, N.Y.
Please send literature on:

- ☐ Bench Comparator, D-297
- ☐ Universal Staging Fixture, D-2007
- ☐ Toolmakers' Microscope
- ☐ StereoZoom Microscopes, D-15
- ☐ Scratch Depth Gage, D-2004
- ☐ Optical Aids, D-1059

NAME .....
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CIRCLE INFORM-A-GRAM KEY NO. 26

Trade Building Mission

Prospects of expanding trade between the United States and Australia in the machine tool and machinery fields are being explored by Philip R. Marsilius, executive vice president of The Producto Machine Co., Bridgeport, Conn. Mr. Marsilius is a member of a five-man team of American industrialists appointed by the U.S. Department of Commerce to serve on a trade-building mission to that country.

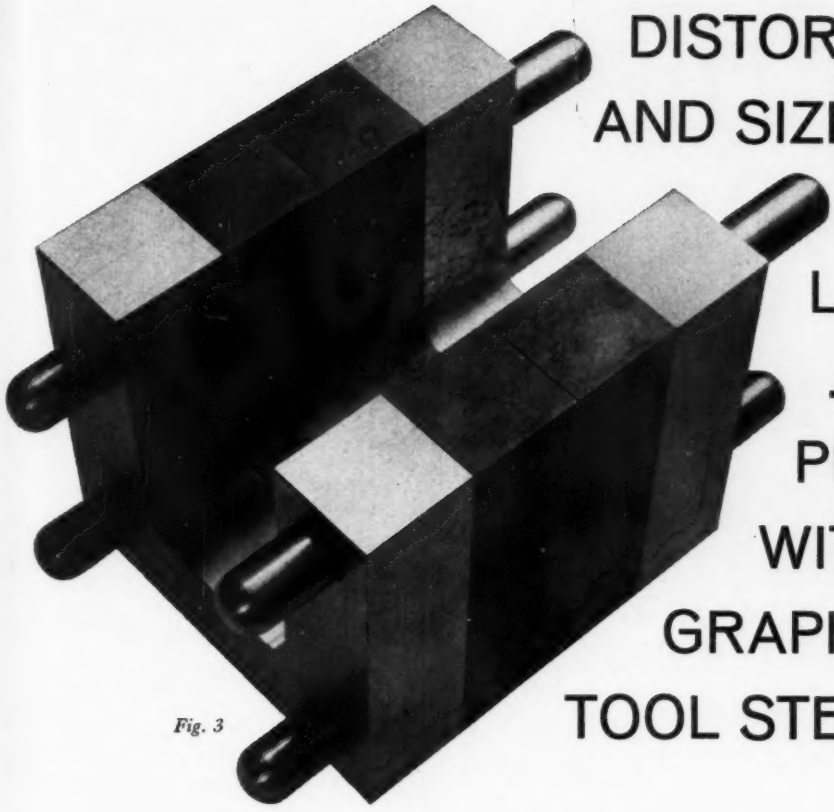
During the seven week visit, he and his colleagues are meeting and conferring with businessmen, industrialists, and provincial and government officials in Australia's key cities. Primary purpose of the mission, in addition to good will, is to find and recommend ways of furthering trade activity between the two countries in specific areas of industry and commerce.

Other members of the mission include Bjorn Anderson, vice president, chemicals and plastics division of Celanese Development Corp.; R. M. Binney, vice president, First National Bank of Boston; George A. Oldham, vice-president, Pegues, Inc.; and William E. Vaugh, manager, administrative division, American Can Co.

Mr. Marsilius, who will visit Japan and India after the Austrailian tour, is chairman of the planning and policy committee of The National Tool, Die & Precision Machining Assn., and a past president of that group.

New Gear Design Book

Basic principles and practices for successful design and manufacture of gears and gear drives are presented in a new book, *Design of Worm and Special Gears*, by Earle Buckingham and Henry H. Ryffel (The Industrial Press, New York).



DISTORTION AND SIZE CHANGE HELD TO LESS THAN .0002" PER INCH WITH GRAPH-AIR® TOOL STEEL

Fig. 3

The test pieces pictured here demonstrate the dimensional stability of Graph-Air® tool steel that enables users to produce more intricate tools and dies.

Fig. 1 shows test piece dimensions. In the "U" shape, which is particularly sensitive to distortion in heat treating, the machining tolerance between any two holes is held to .0002". After heat treating, the specimens are fitted together by four pins having a diameter of .0003" under .500". The total assembly error under these circumstances could not exceed .0008". Distortion must be less than .0002" per inch during heat treatment for the pins to fit.

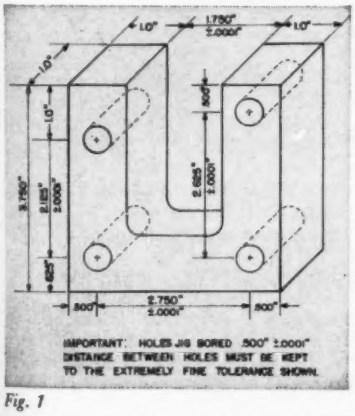


Fig. 1

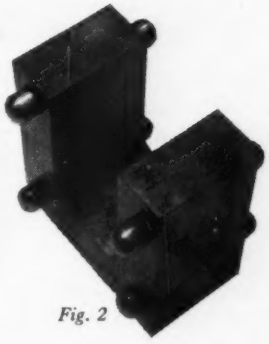


Fig. 2

The Graph-Air pieces tested were from different heats. They were air hardened from 1450°F. and double tempered at 400°F. Fig. 2 shows them as they pegged together easily, demonstrating no distortion. Fig. 3 top, shows the same specimens compared with two green, or as machined, parts. They matched perfectly again. *Graph-Air did not distort . . . did not change size.* Records indicate that no other tool steel passed this test when heat treated at its recommended hardening and tempering conditions.

Specify Graph-Air where minimum distortion and high quality are required. Solid and hollow bar sizes available. It is one of the Timken graphitic tool steels, the most stable tool steels made. The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO". Makers of Tapered Roller Bearings, Fine Alloy Steel and Removable Rock Bits.

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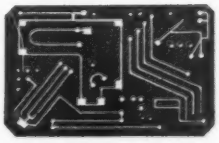

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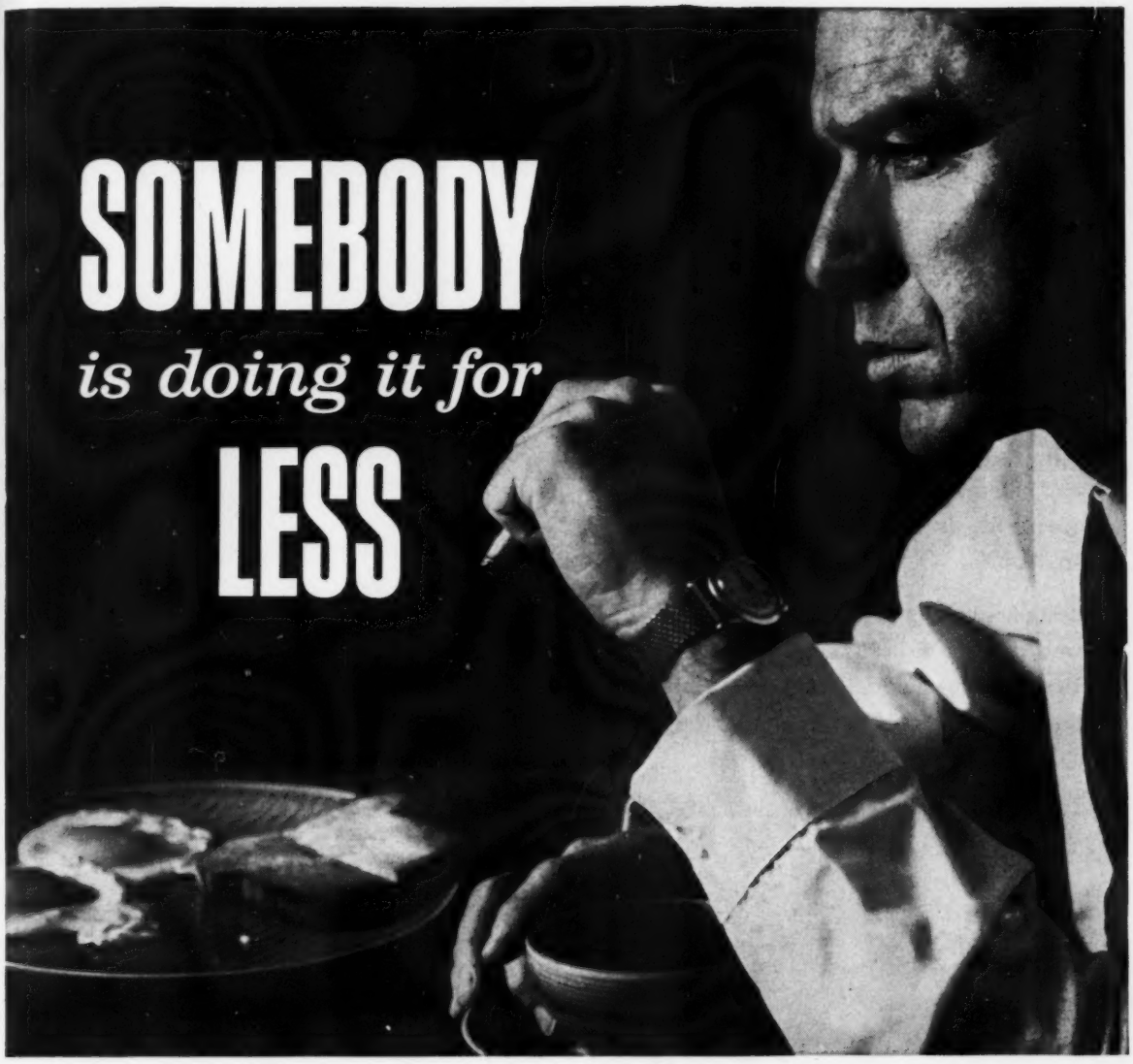

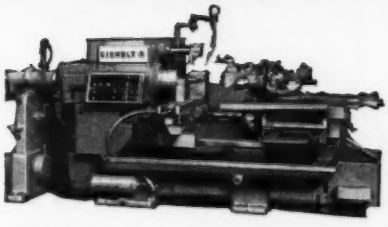

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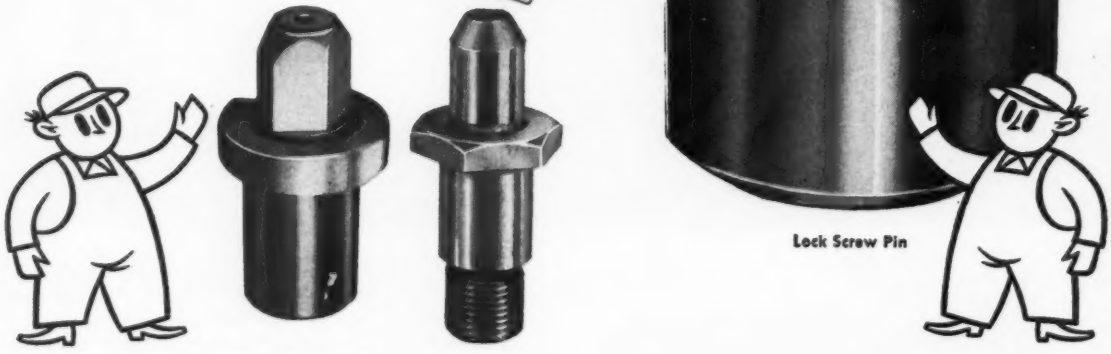

Lock Screw Pin

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OTHER PRECISION-BUILT COST SAVING UNIVERSAL PRODUCTION TOOLS

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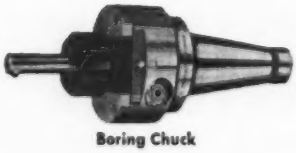
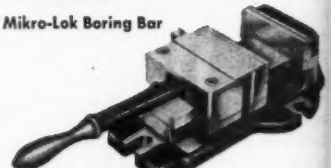


Boring Chuck

"Kwik-Switch" Tool Holder

Standard Drill Bushing



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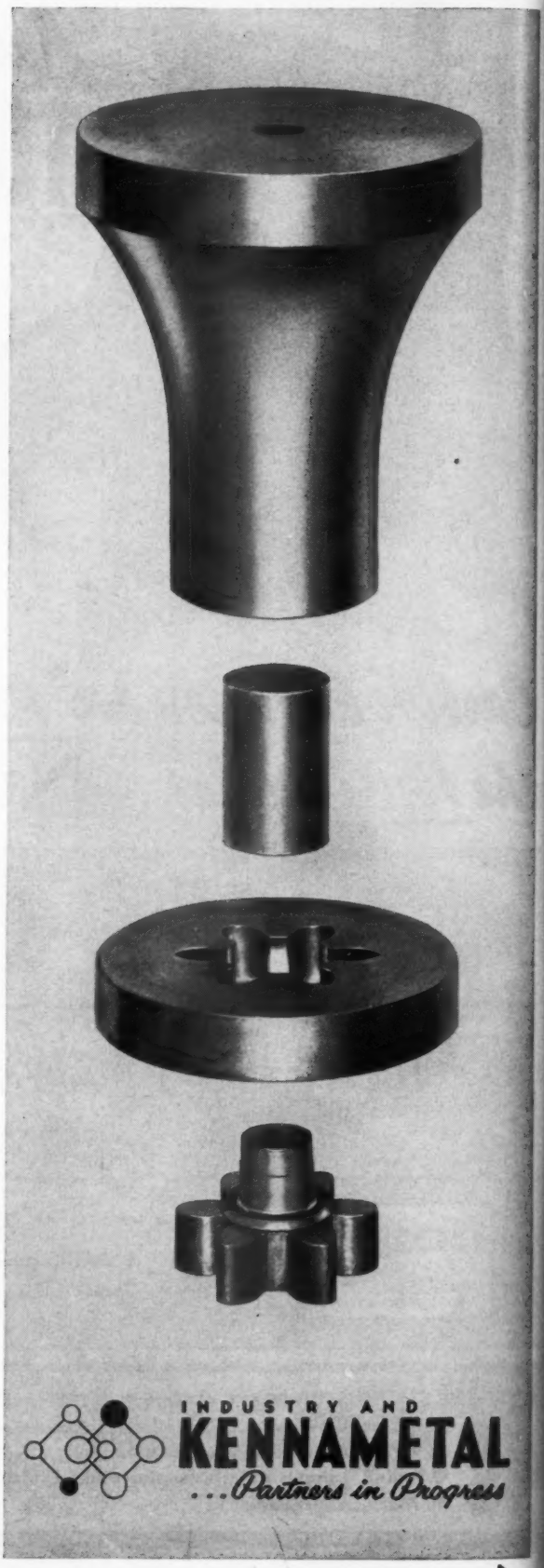
The Kennametal Punch and Die, illustrated at right, were fabricated by the Ideal Carbide Die Company. Used in a Verson Press, they form automobile door latch pinions from small steel blanks.



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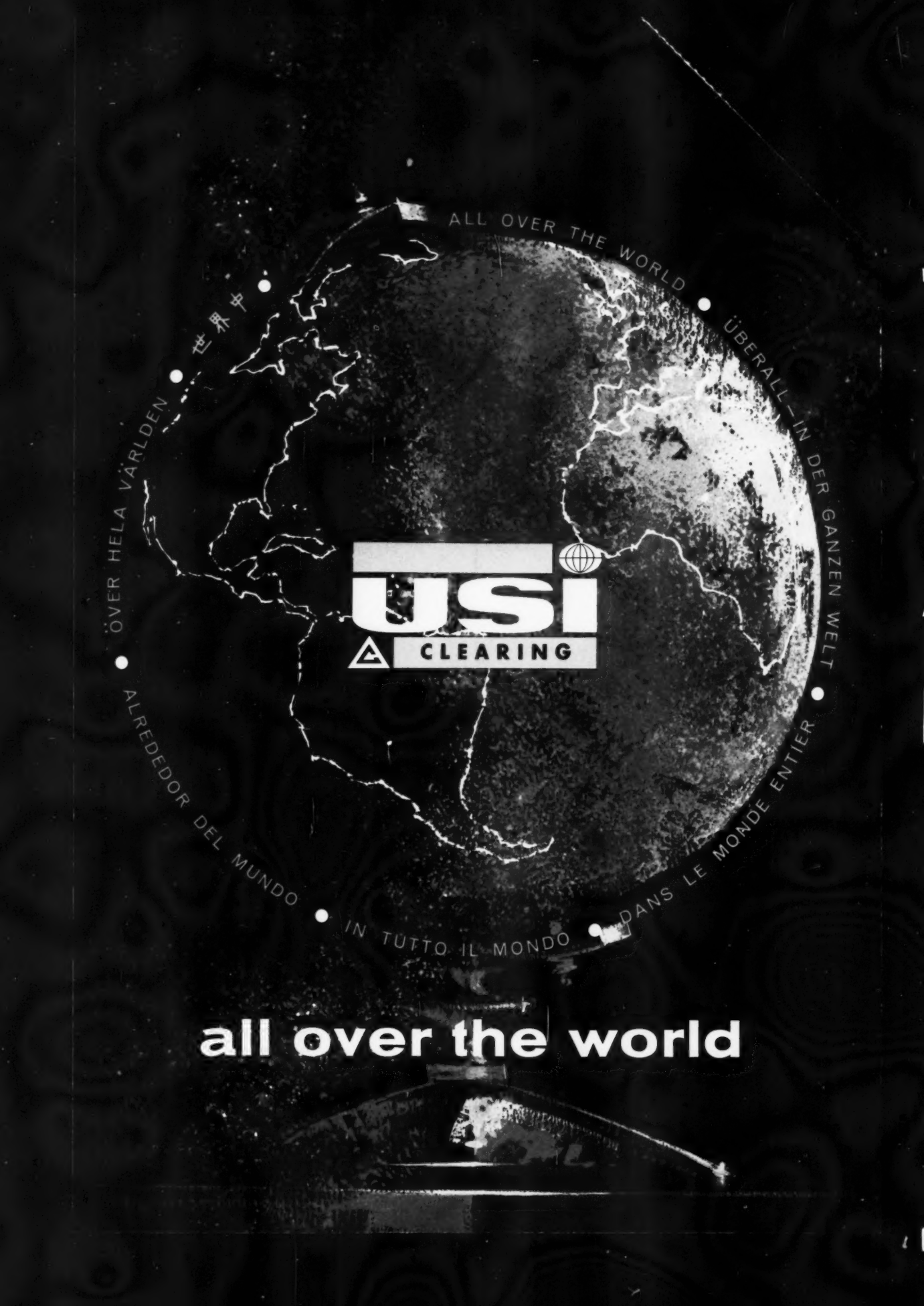
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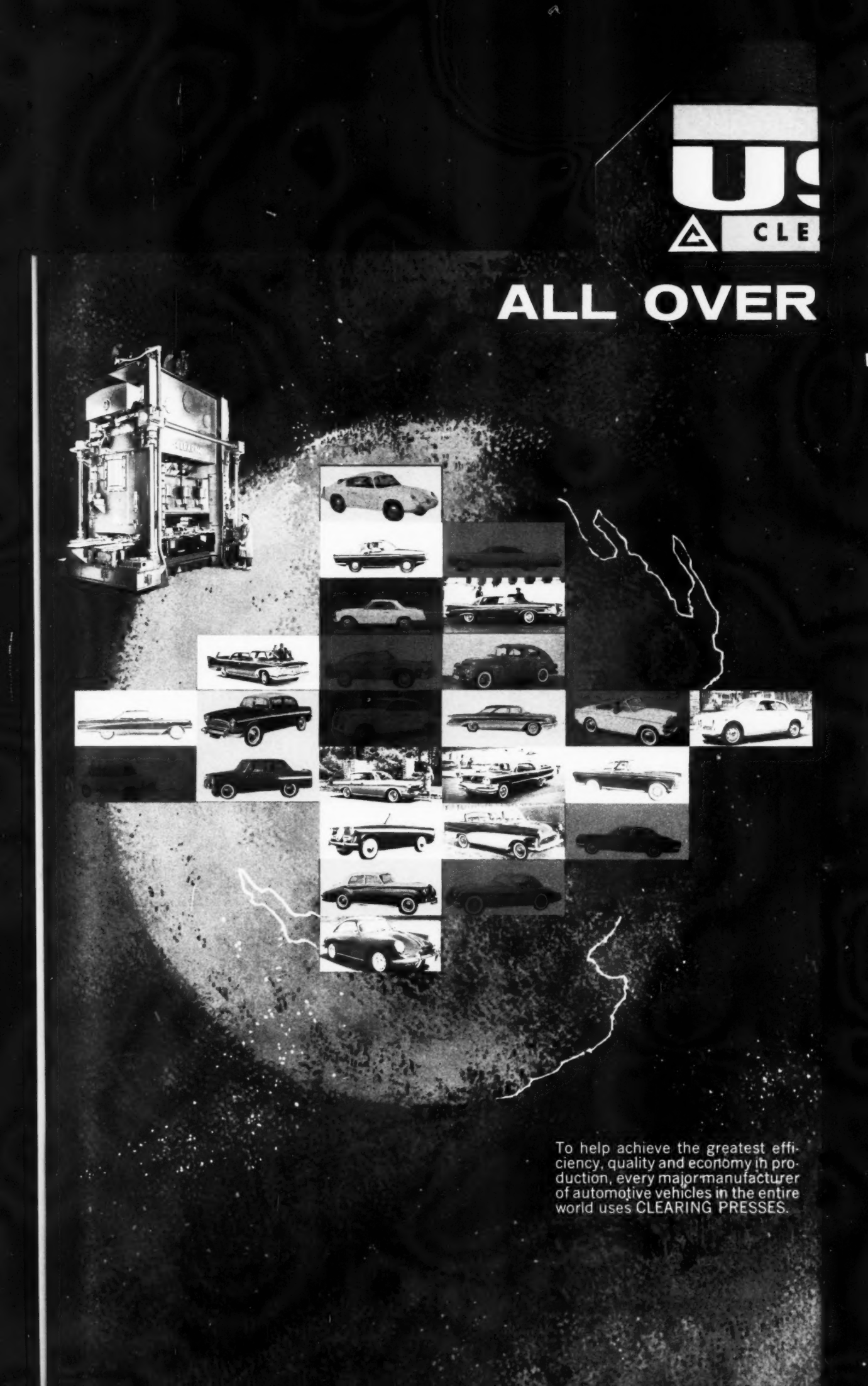
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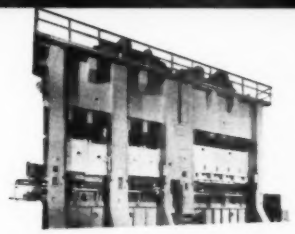

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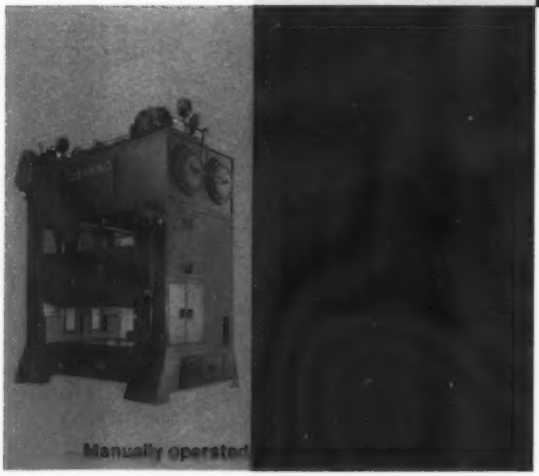
Standard or Special



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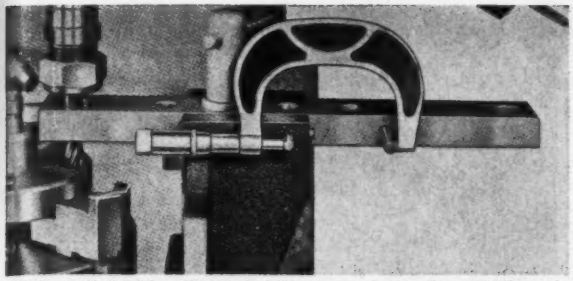
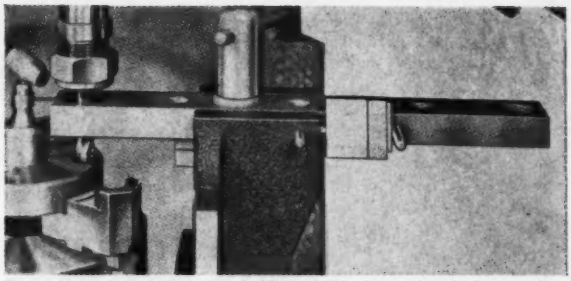


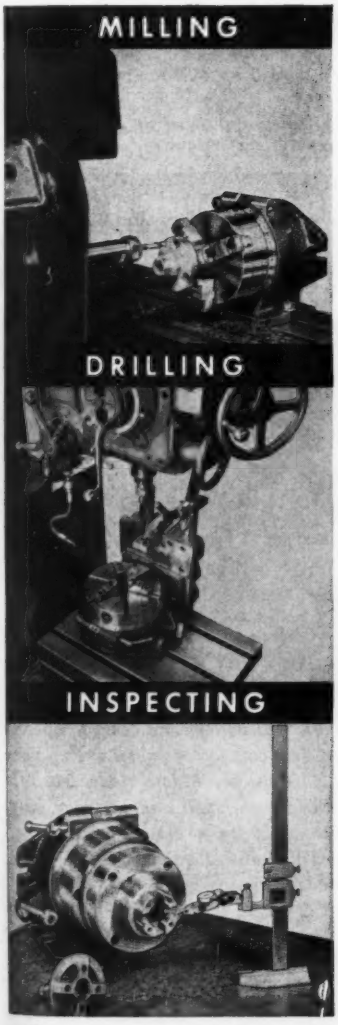
With the vertical drilling attachment, drilling can be done on the end of the workpiece. After aligning the ERICKSON master spacer with the machine spindle, the sliding bar on the attachment is located to the desired accuracy and locked. A direct over-pins micrometer reading gives the distance from master-spacer centerline to center of a drill bushing on the sliding bar.



The machine spindle is then aligned with the drill bushing and machining operations are performed. In the photograph, the drill bushing has been removed for a counterboring operation. Jo blocks were used for extreme accuracy in this setup. A horizontal drilling attachment is available for locating holes (with the same accuracy) on the side of the workpiece.

Micrometer or Jo-block adjustment of drilling attachments bypasses fixture cost and lead time

Get into production fast...with an ERICKSON MASTER SPACER



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The ERICKSON master spacer mounts either horizontally or vertically, so it can be used for machining either the side or the end of the work. For holes on a bolt circle, location is determined by the master spacer and the drilling attachment, and is not dependent upon machine accuracy. The attachment can be set with either a micrometer or with Jo blocks—giving you just the accuracy you need for your job. You can forget drill jigs if you have an ERICKSON master spacer.

Timken-Bearing Spindle Gives Rigidity and Accuracy

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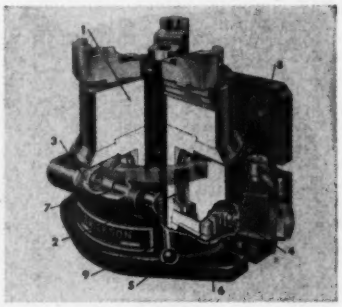

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The manual on the ERICKSON master spacer gives the complete story, including construction details, dimensions, and how the vertical and horizontal drilling attachments are set up and used. Six full pages of solid tooling data—yours for the asking.

ERICKSON TOOL COMPANY

34356 SOLON ROAD • SOLON, OHIO

(Greater Cleveland)

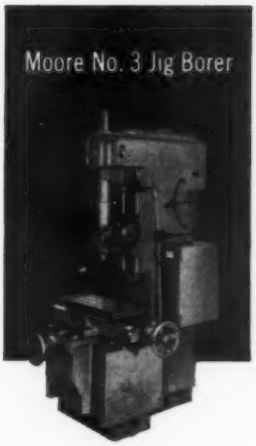
CIRCLE INFORM-A-GRAM KEY NO. 38

CIRCLE INFORM-A-GRAM KEY NO. 39

"The No. 3's split the tenths!"

So report users of Moore's New Jig Borer and Jig Grinder

"Our operators feel that these are the best machines they have ever worked on. They take care of the tenth-splitting tolerances required by industry today. Over the years we have enlarged our Moore Jig Boring and Jig Grinding Department to 15 machines." These are the words of Herbert Harig, President (left above), and Karl Harig, Chairman (at right), Harig Manufacturing Corporation, Chicago, Illinois.



You will easily break the "tenth" barrier with this accurate machine. No gibs...no overhang...improved drive ...speed range of 60 to 2250 RPM...11 x 24" table working surface. It bores, drills, reams and spots holes in dies, jigs and production parts with unequalled speed and accuracy.

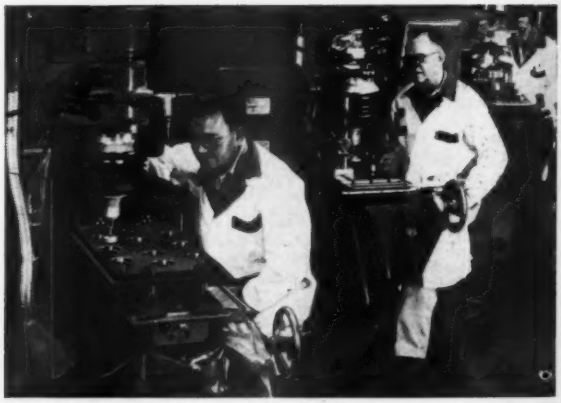
With this new, larger No. 3 model, you can grind—*with split-tenth* accuracy—holes plus regular and irregular contours to size and location after hardening. Faster strokes are provided for chop-grinding... infinite spindle speeds, 40 to 250 RPM...larger table working surface, 11 x 24".

All hardened, ground and lapped ways. Made and calibrated to the new international inch.

Write today for literature describing the many advantages of the No. 3 Moore Jig Borers and Jig Grinders.

MOORE SPECIAL TOOL COMPANY, INC.
800 Union Avenue, Bridgeport 7, Conn.

Among the highly skilled toolroom operators in the Federal Products Corporation, Providence, Rhode Island, is this talented jig grinder operator, Mrs. Florence Smith. Mrs. Smith achieves ultra-precise results with the No. 3 Moore Jig Grinder.



"We have found that it costs real dollars and cents to operate without Moore equipment. This cost factor is just one of many reasons why we recently added the new Moore Model No. 3 Jig Grinder. This Machine, with its tenth-splitting accuracy, hardened ways and wider range, enables us to service more customers better." Statement by Val Koller, President, Koller Die & Tool Co., Milwaukee, Wisconsin.

HOLES, CONTOURS AND SURFACES, Moore's authoritative book, tells how to produce tools, dies and precision parts the modern way. 424 pages, 495 illustrations. $5 in U.S.A., $6 elsewhere.

ADD MOORE TOOLS TO YOUR TOOLROOM

JIG BORERS • JIG GRINDERS • PANTOGRAPH WHEEL DRESSERS • PRECISION ROTARY TABLES • HOLE LOCATION ACCESSORIES

CIRCLE INFORM-A-GRAM KEY NO. 40

Mr. Frank Fields, President of Fosdick Machine Tool Company, Cincinnati, has just come back from a tour of metalworking plants with much food for thought. He visited eight metalworking plants in the Middle West and five in the East. All were large enough to incorporate numerical control into their operations, and sophisticated enough to appreciate what the savings would mean to their manufacturing problems. What Mr. Fields found about numerical control bore out his suspicions aroused at the Machine Tool Exposition. We are pleased to present his reactions from his trip as our guest editorial.

E. Willard Pennington

Editorial Director

Where Have We Fallen Short?

Frank Fields
President
Fosdick Machine Tool Co.
Cincinnati, Ohio

IN SPITE OF TEN YEARS of effort, machine tool users still don't understand the implications of numerical control!

Where have we fallen short? Machine tool builders, sales engineers, manufacturers representatives, and metalworking magazines have all failed alike. All the sales talk, the articles, the ads have only made buyers so conscious of the hardware and techniques that they've missed the forest for the trees.

First you've got to make people understand that numerical control lifts metalworking to a new level of profitability. I don't care whose machine or control you're talking about — that's detail. The important thing is that *every* numerical control system can do this!

Numerical control *saves time.* It cuts out virtually all the leadtime that used to be needed for laying out, or for making jigs, fixtures, and templates.

Numerical control *saves money.* When you can substitute a $25 tape for a $2,500 fixture, you are generating the kind of internal capital which can purchase new machines.

Numerical control makes a permanent *inexpensive* record. And how much easier and cheaper it is to change a hole in a paper tape than it is to change a hole in a drill jig.

Numerical control is *accurate.* It is more precise in most cases than the machines it operates.

Numerical control reduces *inventory.* It makes short runs pay, so there's far less need to stockpile parts, jigs, and fixtures. Remember, stockpiled inventory is taxable, it ties up capital and floor space, it becomes obsolete when models change.

Sometimes, I get the feeling that once a person says something clearly, he thinks he doesn't need to say it again. When only a few manufacturers are taking advantage of the huge savings available through numerical control, it is ample evidence that we can't repeat a right idea too often.

NOW BULLARD PRICED LOWER!

NEW Bullard Mult-Au-Matic Type "M"

Contrary to the general upward trend in the cost of new plant production equipment, The Bullard Company is offering the *new* Type "M" Mult-Au-Matic at a price which is *lower than competitive methods.*

Designed and built according to exacting Bullard standards, the *new* Type "M" Mult-Au-Matic incorporates many new features of rigidity, accuracy and productivity which have made this machine famous the world over.

For complete information on the *new* Bullard Type "M" Mult-Au-Matic, call your nearest Bullard Sales Office or Distributor or write to

The Bullard Company, Bridgeport 9, Conn.

CIRCLE INFORM-A-GRAM KEY NO. 42

TOOLING & PRODUCTION

The Magazine of Metal Working Methods

VOL. XXVII, No. 1
APRIL 1961

A typical well organized central tool grinding room, well lighted and equipped with the special purpose machines for each type of sharpening job.

Twelve Ways to Reduce Tool Grinding Costs

by William H. McNeilly

Mr. McNeilly is product engineer and a specialist on toolroom grinding at Norton Co., Worcester, Mass.

PART OF YOUR COMPANY'S PROFITS are made whenever a way is found to cut costs. One place to start looking for greater profits is in your toolroom. You will probably find that the "dollar stealers" here aren't people, but methods and practices which have been outmoded.

Check these points on toolroom operation to see if your toolroom is contributing toward profits:

1) Are your tools sharpened soon enough?

Production machines are only as good as their cutting tools, and cutting tools are no better than their sharpening. The operator who brags about how long he uses a tool is the victim of obsolete notions of tool economy. Operating a tool beyond its normally dulled condition consumes too much power, produces poor finishes and may ruin the tool. At the very least, it will shorten the life of expensive tools because heavier grinding will be required to restore the cutting

edge. Knowing when to sharpen is good economy.

2) Do specialists sharpen the tools?

At one time, machinists justifiably took pride in making and sharpening their own tools. In today's high production operations, this job is more efficiently handled in central tool grinding room. While the machinist is sharpening his own tools, he is not producing work on his machine. Then too, his way of tool sharpening may not be the best in the light of modern tool engineering.

Proper sharpening requires proper organization. The increased costs of tooling, labor and machines indicate the need for centralized tool grinding rooms where the most efficient equipment can be used by skilled tool sharpeners. Under management supervision and training, these specialists can increase the efficiency of plant operations by reconditioning tools according to print specifications established by tool engineers.

3) Are you using the proper toolroom grinders?

The central tool grinding room's equipment must be suitable for the work to be done. A universal cutter and tool grinder, preferably one with a tilting wheelhead, is a necessity where multi-toothed cutters and formed tools must be sharpened. The machine must be in good operating condition, with free-running but snug spindle bearings. Accessory equipment must fit properly and be suitably chosen for the operation.

Single point tool grinders with adjustable work rests are also essential. Separate grinders for carbide and high speed steel tools save time in changing grinding wheels and are a good investment if work volume is high enough. Drill and tap sharpeners are important toolroom machines. For other operations such as sharpening flat form tools and dies, a 6 or 8″ surface grinder and a universal grinder may be needed.

A well trained operator with the proper tool grinding equipment is essential in keeping tool grinding costs at a minimum.

With this combination of essential grinders, the skilled tool sharpener can perform just about any grinding required.

4) Are your tools inspected properly?

To control the quality of the work performed in the tool grinding room, it is important to have the proper inspection instruments. Optical comparators, surface finish indicators, master templates, surface plates, dial indicators, etc. are important. They check the accuracy of the tool grind, which affects the accuracy and rate of work on the production line.

5) Are you using the proper grinding wheels?

Since the grinding wheel is the basic tool for resharpening the cutting tools used on the production line, it must be properly selected for the job to be done. There is a correct grinding wheel specification for each sharpening job, and having the correct one saves time in setup and grinding time.

For sharpening tools of high speed steel or cast alloys, a free-cutting wheel is required to avoid burning the cutting edges. Hence, a friable (relatively easily fractured) aluminum oxide abrasive is recommended. To promote the self-sharpening action of the grinding wheel and to avoid dulling the wheel face, the softer grades of wheels, H through M, are used. Coarse 46-grit wheels are often used for rough grinding, with finer 80-grit wheels for finish grinding.

There are variations from these general recommendations. In Diaform grinding, a 100-grit, G-grade wheel is a widely used specification. In intricate form grinding, where the wheel must hold form, a 150-grit M-grade, or even a 220-grit O-grade wheel may be used. A vitrified bond is specified for practically all high speed steel and cast alloy grinding. Exceptions occur where thin wheels are used for slotting, grooving, and cutoff operations. In these cases, rubber or resinoid bonded wheels should be used.

For grinding cemented carbides, wheels of two different abrasives are generally required. Silicon carbide wheels are used for off-hand roughing on single point tools. Finishing on single point tools, and precision sharpening of all multi-toothed cutters, is best accomplished by using free-cutting, long lasting diamond wheels.

Although the initial cost of a diamond wheel is high, its performance and resistance to wear makes it the most economical tool to sharpen carbides.

The new man-made diamonds are particularly well suited for toolroom grinding, offering longer wheel life, with better cut and finish, than the diamond wheels previously available. The flaring cup diamond wheel is widely used because of its ability to grind a variety of carbide multi-toothed cutters and reamers. For rough grinding, a 100-grit, R-grade, 100-concentration, resinoid-bonded diamond wheel is most commonly used. For finish grinding, 180 grit is recommended with other specifications remaining the same. If one wheel is to be used for both operations, a 150-grit wheel is a good compromise.

Although the practice is quite unusual, the tool grinding room of one leading manufacturer of electrical tools uses diamond wheels as fine as 1500 grit for super finishing its carbide tools, and reports substantial improvements in tool life.

6) Do you have a diamond mine?

If you use diamond wheels, there's money in your swarf collection system. Diamonds can be reclaimed from the swarf and from the stubs of worn-out wheels. The large diamond wheel manufacturers who provide such a service will pay a good price, as high as $1.85 a carat. One company recently sent its first lot for reclaiming and was rewarded with a check for $5000.

Don't mix swarf from diamond wheels with the swarf from silicon carbide or aluminum oxide wheels. Doing so may dilute the percentage of diamonds to the point where salvage is not practical. Your diamond wheel supplier can give you complete details on how to collect swarf and return it for salvage.

7) How is your supply of tools?

Part of your production planning should include a determination of the inventory of tools needed to keep production running without interruption. Properly sharpening a tool takes time and experience. Have enough tools on hand so the toolroom can have a spare ready to go while a dulled cutter is being resharpened.

The use of diamond wheels may speed grinding to the point where fewer costly tools are needed in inventory.

8) Are tools ground to a standard?

The manufacturers of cutting tools will gladly advise you as to the best tooth geometry for their cutters for specific applications. Many progressive tool engineers maintain a card file on each type of tool. The tool sharpener refers to this for the proper tooth form (rake and relief angles) each time the tool is reground. Local standards, developed through experience, should be recorded on these cards.

9) Do you keep records on expensive tools?

Records which indicate price and date of purchases, dates of resharpening, hours of production between resharpening, cross referenced standard data, etc. often aid in analyzing and reducing tool costs. Such records are generally confined to expensive cutters and formed tools.

10) Are you salvaging broken tools?

Many broken tools of high speed steel can be salvaged by cutting off the broken portion and regrinding to the original form. A shellac bonded cutoff wheel, about 60-grit N-grade, is recommended for this. Although the wheel may wear relatively fast, its cool cutting action will preclude any tendency to burn the tool material.

Some toolrooms have stretched the life of their throw-away carbide tool bits by regrinding them at least once with diamond wheels. Tool life after such resharpening may be less than that of a new tool bit, but careful study may show that this procedure can save on tool costs.

11) How is your operator training program?

Proper training of apprentices, followed by regular on-the-job instruction for advanced tool sharpeners, assures top quality workmen. More formal courses which stress some of the theories of tool engineering may be a desirable way to upgrade qualified operators. Such courses are given by many employers, usually after working hours, to men who want additional training. In major industrial areas, these courses are often sponsored by local trade schools or technical societies. A man with a good background of practical and theoretical know-how is a valuable member of any production team. And don't underestimate the psychological value of the prestige a man feels when his company pays his way to a special training course.

12) Do you consult suppliers?

Toolroom supervisors should consult frequently their suppliers of grinding wheels and other tools. New abrasives or grinding wheel bonds, new tool materials, and new techniques are being developed constantly. Take advantage of the specialized experience that trained representatives of these companies can offer you. They will take a genuine interest in your problems because their repeat business depends upon their ability to help you reduce costs.

* * *

Each of these dozen ideas for cost reduction has been applied by toolrooms somewhere, and increased profits have resulted. How many of them can help you?

Extra copies of this article are available while supply lasts. Write Tooling & Production Magazine 1975 Lee Road, Cleveland 18.

PRODUCTIVITY WALL CHART

THIS MONTH, as a special service to our readers, Tooling & Production is pleased to publish in chart form a definition of productivity and the economic factors that will assure continued growth of our material welfare.

The chart is deserving of careful, serious study by all thinking Americans. You will find that by tearing along its perforations it is easily removed from the binding, and we recommend that it be posted on your company's bulletin boards. For extra copies write to Leighton A. Wilkie, 254 N. Laurel Avenue, Des Plaines, Illinois.

In effect a new form of book, the chart enables you to grasp the basic rules of economics quickly and gives you a better mental image of how we, as a people, have risen to our present high standard of living.

We believe it is especially pertinent at this time for Americans to understand these economic facts of life. Unless our citizens have a clear understanding of the factors that brought our people the enviable high standard of living they enjoy today they cannot intelligently and collectively know how to maintain our leadership in the face of challenges from abroad.

Today, too many Americans seem to take our industrial pre-eminence and unmatched economic welfare for granted, as if these things always were so and always will be so. This attitude is further nurtured by the semantic confusion of such terms as "productivity," "profit squeeze," "inflationary trend," "gold flow," "depreciation allowance," and so forth. There even exists a basic lack of understanding of such fundamentals as "What is money?," "What is the stock market?," "What are machine tools?"

The productivity chart opposite answers these questions and clarifies a complex subject that otherwise would have to be obtained from dozens of books on economics.

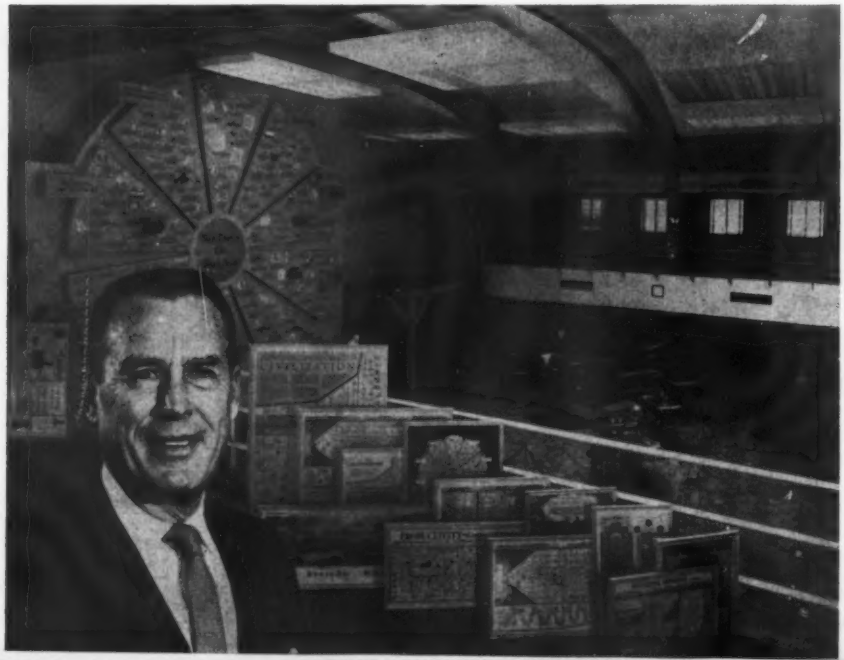
The author, Leighton A. Wilkie, Board Chairman of The DoALL Company, suggests studying the chart in the following sequence:

1. Read the headline captions.

2. Read the section, "How Living Improves" for the basic philosophy of the American way of life.

3. Read the 10 horizontal bands from 1900 to 1960, beginning at the upper left. The top one is a record of American genius; these patents are ideas that start the mechanism of productivity. The other 9 are the main classifications of capital goods. Each unfolds a progressive story of how the development of new and more efficient tools helped fashion better life for all. Together the 9 compose a picture of how productivity creates the economic wealth that produces our unprecedented standard of living.

4. Read the section at the right of the chart under the 2 graphs.



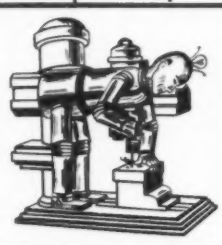
Leighton A. Wilkie has won three Freedoms Foundation awards for his educational charts and exhibits, a lifelong avocation. Here he is shown with his dramatization of the industrial revolution, "The Dawn Of This Age" in the DoALL Company's famed Hall Of Progress.

Productivity is a measure of the efficiency with which resources are converted into the commodities and services that people want.

PRODU

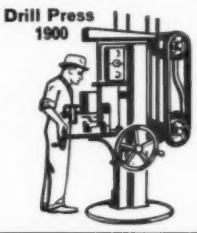
Productivity Starts from Research & Development	26,499 Patents Issued in 1900	26,775 Patents Issued in 1901	28,484 Patents Issued in 1902	31,701 Patents Issued in 1903	30,934 Patents Issued in 1904	30,399 Patents Issued in 1905	31,965 Patents Issued in 1906	36,620 Patents Issued in 1907	33,682 Patents Issued in 1908	37,410 Patents Issued in 1909	35,930 Patents Issued in 1910	34,084 Patents Issued in 1911

Machine Tools (The Tools That Make Other Tools)



These robots are the key to all industrial production. They alone are able to make machinery for steel mills, power plants and production. Machine tools also make duplicate interchangeable parts for mass production.

Drill Press 1900



Throughout the history of our advancement, the relatively small machine tool industry has supplied the basic means of production.

Power Generation

Mechanical and electrical energy take the work of making and transporting things off the backs of men and animals. They result in abundant material welfare along with vast opportunities for the growth of educational, recreational, cultural and spiritual pursuits.

Tools for Transportation & Communication

Steamboats penetrated the interior to develop our rich river valleys.

Over 4,000 river steamboats were used in their first 100 years (1807-1907).

Production Facilities for Food and Fibers

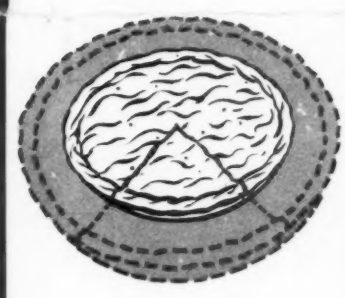
As 20th century began, it took back-breaking toil of one-third of all Americans to produce our food and fiber. Housewife and farmer both slaved from dawn to dusk just to get people fed. But at farm experiment stations and universities, a new activity was just beginning. It was called research, a scientific quest which today has revolutionized farming.

Production Facilities for Textiles and Clothing

By the year 1900, food and clothing (the two foremost requirements of mankind) were beginning to become plentiful for everyone. With machine improvements in textile making and machine-made clothing, people had better and more comfortable clothes than ever before.

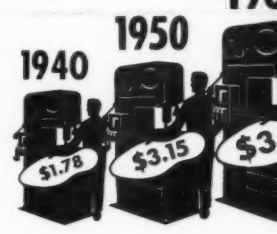
HOW LIVIN

"The material welfare of people is in direct proportion to what they produce."



"There is no solution in re-distributing the same pie. That pie must be made bigger."

"Economic growth upon increasing the output per man hou



With Tools Worth $6,000 per Man

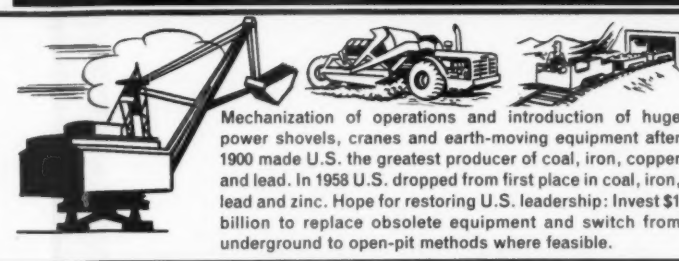
With Tools Worth $15,000 per Man

"To increase the valu hour, we must invest in them efficiently."

***To Achieve the Greatest Good**

Production Facilities for Structural Materials

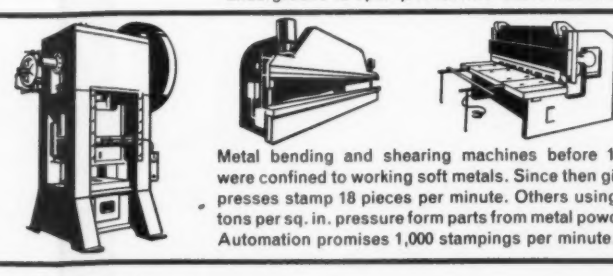
Lumber mills, stone quarries, brick kilns and iron foundries were the "tools" that accounted for most basic structural materials up to 1900. The new materials of the 20th century for making buildings and products came through technological progress, vast production facilities.



Mechanization of operations and introduction of huge power shovels, cranes and earth-moving equipment after 1900 made U.S. the greatest producer of coal, iron, copper and lead. In 1958 U.S. dropped from first place in coal, iron, lead and zinc. Hope for restoring U.S. leadership: Invest $1 billion to replace obsolete equipment and switch from underground to open-pit methods where feasible.

Facilities for Manufacturing

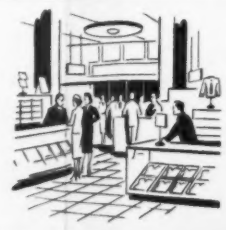
By improving and increasing the facilities for making things, man raises his productivity and thus improves his standard of living. Increased productivity comes from better tools and using them efficiently. Since 1900 U. S. manufacturing plants have increased their over-all productivity an average of 2% annually.



Metal bending and shearing machines before 1900 were confined to working soft metals. Since then giant presses stamp 18 pieces per minute. Others using 75 tons per sq. in. pressure form parts from metal powder. Automation promises 1,000 stampings per minute.

Facilities for Exchange

The dingy stores, cracker barrels, butter tubs and open bins of 1900 soon vanished. More efficient tools of marketing and distribution were developed to give customers much more for less money.



It took the majority of U.S. workers in 1900 to raise and make th Today it takes almost as many workers to distribute the pro of farm and industry and to provide services. While popul increased 50% between 1929 and 1960, employment in agricu and manufacturing remained the same; but in wholesaling, ing and services, employment expanded by 8.3 million (

Money, Banking, Credit and Insurance

Money is a necessary tool of exchange, valueless in itself but representing the value of goods or services delivered.

Coins are a tiny percentage of our money.

Aside from gold, money is nothing but pieces of paper with numbers on them as measures for exchanging what we produce.

ODUCTIVITY—

These Are the "Tools" (

30	34,084	37,731	35,788	41,850	44,934	45,927	42,760	39,941	38,598	39,882	41,401	40,297	40,787	45,500	47,540	50,627	44,444	45,899
nts ed	Patents Issued in																	
10	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928

There Are 7 Basic Forms of Metal-Cutting Machine Tools

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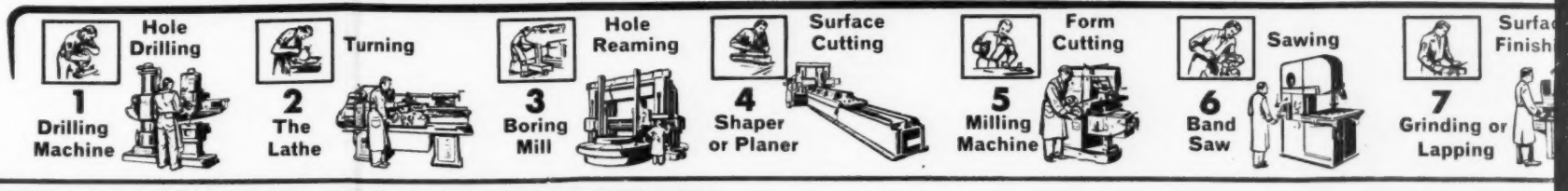


VING IMPROVES*

growth depends entirely
using the potential
man hour."

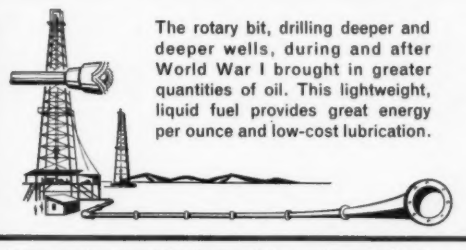
With Tools Worth $15,000 per Man | With Tools Worth $19,500 per Man | With Tools Worth $28,000 per Man

*e the value of output per man
st invest in better tools and use
tly."*

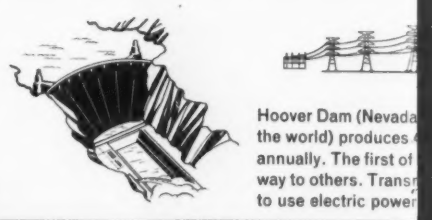
"As productivity increases these 4 factors must balance."

"In a free economy these four elements keep in balance if not thrown out of balance by government decree or by demands from pressure groups."

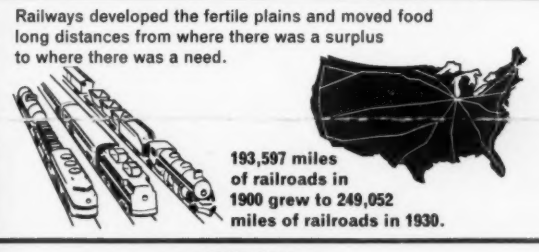
Good for the Greatest Number of People



The rotary bit, drilling deeper and deeper wells, during and after World War I brought in greater quantities of oil. This lightweight, liquid fuel provides great energy per ounce and low-cost lubrication.

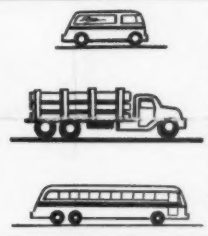


Hoover Dam (Nevada
the world) produces
annually. The first of
way to others. Trans
to use electric power



Railways developed the fertile plains and moved food long distances from where there was a surplus to where there was a need.

193,597 miles of railroads in 1900 grew to 249,052 miles of railroads in 1930.



Motor vehicles p
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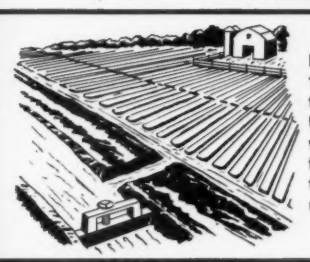
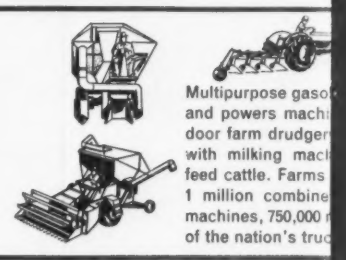


Food from arid land . . . in 1900, irrigation in U.S. was a trickle. By 1952, five million U.S. acres (100,000 farms) were irrigated to grow citrus fruits, nuts, vegetables, cotton—food and fiber we would not otherwise have.



Multipurpose gaso
and powers machi
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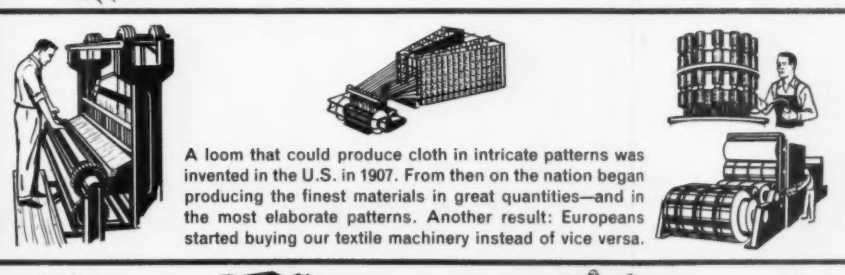
with milking mac
feed cattle. Farms
1 million combine
machines, 750,000
of the nation's truc



A loom that could produce cloth in intricate patterns was invented in the U.S. in 1907. From then on the nation began producing the finest materials in great quantities—and in the most elaborate patterns. Another result: Europeans started buying our textile machinery instead of vice versa.

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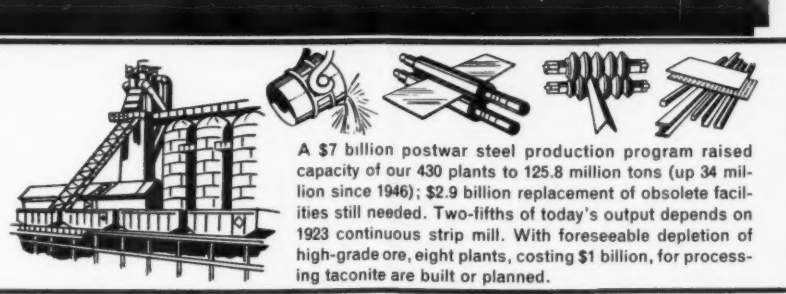
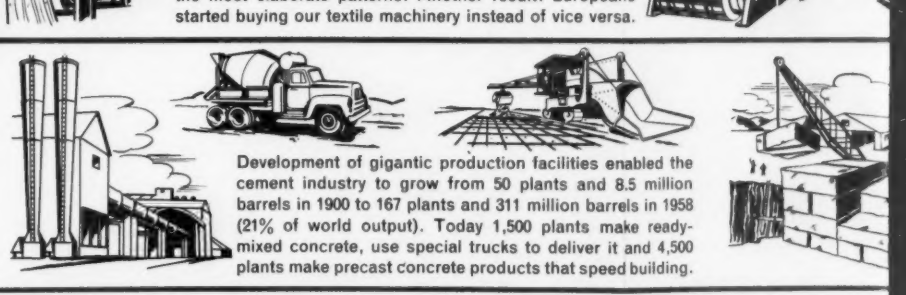


A $7 billion postwar steel production program raised capacity of our 430 plants to 125.8 million tons (up 34 million since 1946); $2.9 billion replacement of obsolete facilities still needed. Two-fifths of today's output depends on 1923 continuous strip mill. With foreseeable depletion of high-grade ore, eight plants, costing $1 billion, for processing taconite are built or planned.



Development of gigantic production facilities enabled the cement industry to grow from 50 plants and 8.5 million barrels in 1900 to 167 plants and 311 million barrels in 1958 (21% of world output). Today 1,500 plants make ready-mixed concrete, use special trucks to deliver it and 4,500 plants make precast concrete products that speed building.

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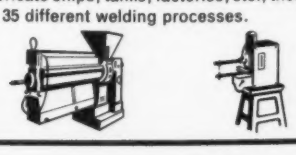
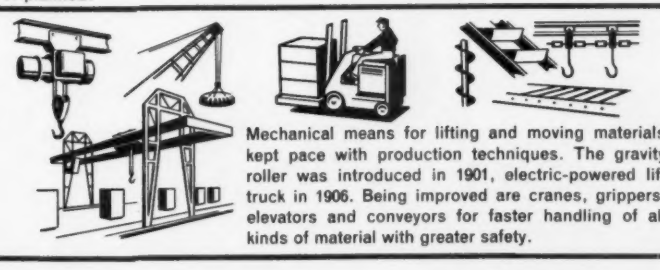
Technological developments in forming materials include injection molding and extrusions. Parts are squeezed out in larger, stronger and lighter sections instead of fabricated from small parts. To fabricate ships, tanks, factories, etc., there are some 35 different welding processes.





Mechanical means for lifting and moving materials kept pace with production techniques. The gravity roller was introduced in 1901, electric-powered lift truck in 1906. Being improved are cranes, grippers, elevators and conveyors for faster handling of all kinds of material with greater safety.

In last 20 years new, better facilities for m
paper pushed production from 10.5 to 30.8 m
tons. Manufacturing 7,000 kinds of paper has be
one of the world's most important industrie
modern paper-making machine may occupy an
city block, produce 2,000 ft. of paper per m

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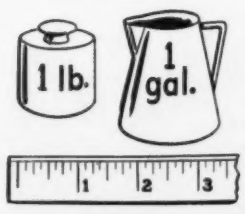
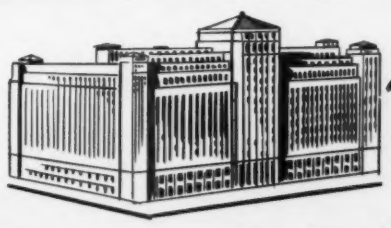
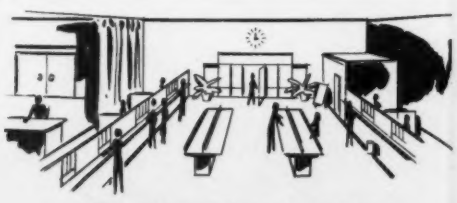
8.3 million (86%).



The National Bureau of Standards, established in 1901, sets standards for weights and measures. These standards are enforced by the Federal Trade Commission to assure adherence by industry and commerce for customer protection.

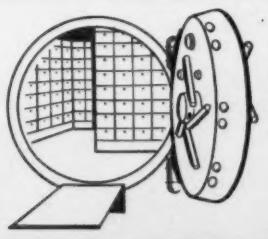


Chicago's Merchandise Mart (left), with 4 million sq. ft. of floor space, is the world's largest commercial building. Opened in 1930, it houses wholesale offices with 30,000 employees. Wholesale establishments (including warehouses and storages) more than doubled (to 316,000) since 1929, and employment doubled (to 3.1 million) since 1943.



The money exchange is the bank.

By bringing together lenders and borrowers, banks put the accumulated savings of depositors to productive work. Total volume of bank deposits increased from $8½ billion in 1900 to $251 billion in 1958.



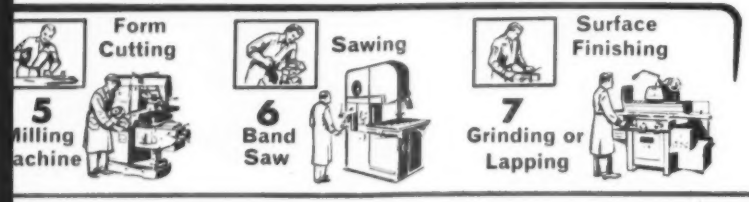
In actual usage money is a receipt which we receive when we give something up (be it services we perform or some specific product) and which we use later to exchange for something else.

ITY-Creates All

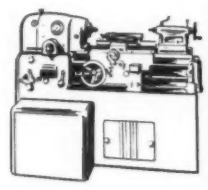
"Tools" (Usually Called Capital

297 ents ued n 22	40,787 Patents Issued in 1923	45,500 Patents Issued in 1924	47,540 Patents Issued in 1925	50,627 Patents Issued in 1926	44,444 Patents Issued in 1927	45,899 Patents Issued in 1928	48,565 Patents Issued in 1929	48,322 Patents Issued in 1930	55,098 Patents Issued in 1931	56,810 Patents Issued in 1932	51,530 Patents Issued in 1933	47,721 Patents Issued in 1934	44,899 Patents Issued in 1935	44,771 Patents Issued in 1936	43,216 Patents Issued in 1937	43,452 Patents Issued in 1938	49,035 Patents Issued in 1939	48,765 Patents Issued in 1940	47,916 Patents Issued in 1941

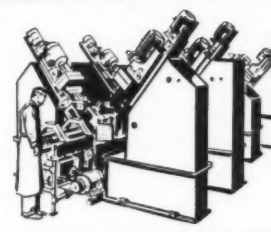
Cutting Machine Tools



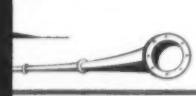
A super-hard man-made metal for cutting tools.

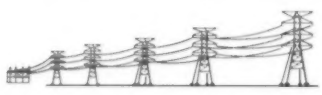


Tungsten carbide cutting tools on automatic machine tools greatly increased productivity.



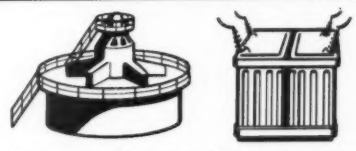
drilling deeper and during and after brought in greater il. This lightweight, vides great energy ow-cost lubrication.





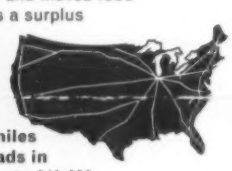
Hoover Dam (Nevada), 726 feet high (the highest in the world) produces 4,330 million kwh of electricity annually. The first of the great dams, it pointed the way to others. Transmission lines make it possible to use electric power far from its source.

Coal was the fuel that fired the industrial revolution. Today power plants are still the biggest users of coal. It is the fuel the U. S. has the most of. We have enough for the next 100-200 years and we know where and how to get it. Mechanization made low-cost coal mining.



The dynamo changes mechanical power into electrica U. S. production went from 91 billion kw hours in 19 billion in 1958. Electric motors permit wide application venient power packs for most stationary tools.

ns and moved food as a surplus



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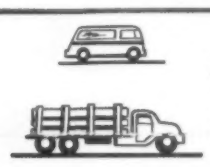
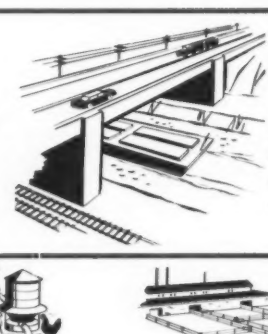
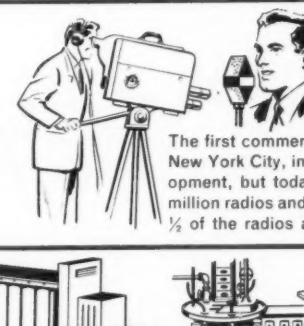


Motor vehicles permitted universal exchange of goods and services. Trucks were first mass produced (300,000 a year) in World War I. Soon they were reaching 25,000 U.S. towns not on railroads. 12 million trucks in 1961 haul everything you buy at some stage on its trip from producer to you.

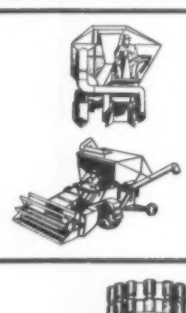


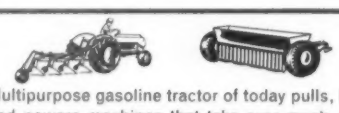
Highways (3½ million miles in 1960, of which half are paved), bridges (vital links in highway system), tunnels, canals, tracks and phone wires are tools that keep U.S. knit together. Road network is so vital that 100,000 miles (4 times world's circumference) is repaired annually.



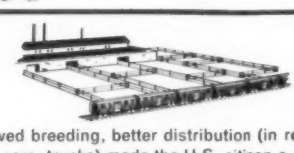
The first commercial TV t New York City, in 1941. W opment, but today U.S. h million radios and 68 millio ½ of the radios and ½ of

Food from arid land . . . in 1900, irrigation in U.S. was a trickle. By 1952, five million U.S. acres (100,000 farms) were irrigated to grow citrus fruits, nuts, vegetables, cotton—food and fiber we would not otherwise have.

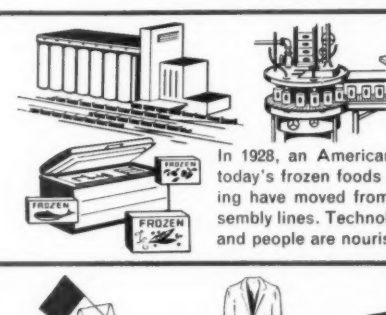




Multipurpose gasoline tractor of today pulls, lifts and powers machines that take over much outdoor farm drudgery. Indoor work is mechanized with milking machines and conveyor belts to feed cattle. Farms today have 6 million tractors, 1 million combines, 1 million special purpose machines, 750,000 milking machines and one-fifth of the nation's trucks.

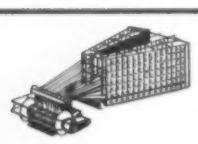


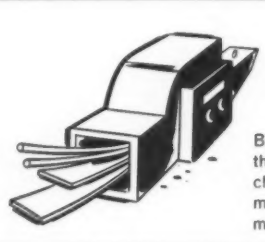
Improved breeding, better distribution (in refrigerator cars, trucks) made the U.S. citizen a great meat eater—127 pounds a year by 1935-39, 159 pounds a year now. Today, poultry is bred for white meat. Fish catch is enlarged by sonar, which locates schools of fish.

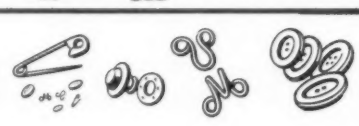


In 1928, an American, Clarer today's frozen foods industry. ing have moved from home t sembly lines. Technology impr and people are nourished on

could produce cloth in intricate patterns was e U.S. in 1907. From then on the nation began e finest materials in great quantities—and in borate patterns. Another result: Europeans our textile machinery instead of vice versa.

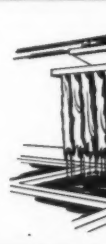






Buttons were better when molded from plastic than those carved from oyster shells. A big change in fasteners came through the development in 1913 of automatic machinery capable of mass producing the zipper of metal and plastics.

In 1923, 106 pounds of a little-known substance called rayon (man-made silk) were produced. Ingenious special machinery put rayon on its way. Today rayon and other synthetic fibers make up one-fourth of our total textiles.



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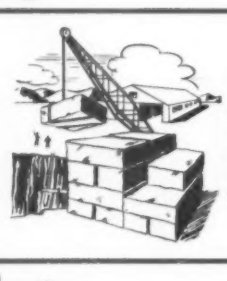
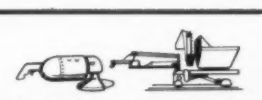


Development of new processes and plant equipment raised aluminum production steadily from 65,000 tons in 1917 to a record 1,900,000 tons in 1959. Now it is the second most widely used metal. Magnesium, only ⅔ the weight of aluminum, is destined to be used increasingly. Production was 3,000 tons in 1939, 27,000 in 1958.

Today 53,000 mills turn out an average 35 million board ft. of lumber annually. Even so nearly one-half the facilities were installed before 1945, and they should be replaced. U.S. is world's largest consumer of lumber.



Electric furnaces, mechanizatio power units are a few of many duced since 1900. Shell molding icant, removes old limitations attains tolerances of .004 in. or strong metals have brought de minum and magnesium castings

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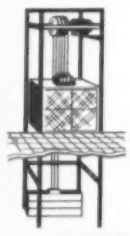
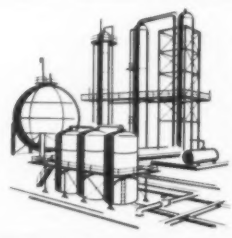


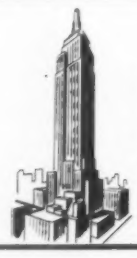
In last 20 years new, better facilities for making paper pushed production from 10.5 to 30.8 million tons. Manufacturing 7,000 kinds of paper has become one of the world's most important industries. A modern paper-making machine may occupy an entire city block, produce 2,000 ft. of paper per minute.



Oil refining facilities are only 100 years old. With assets of $37.5 million and 2 million employees, the industry's annual production gushed from 209 million to 2,500 million barrels between 1910 and 1955. U. S. produces nearly half the world's supply for fuels, lubrication, lighting, paving, synthetics, fibers, rubber, detergents, paints, plastics, fertilizers, insecticides, medicines. But expanding world production is shrinking U. S. share—from 71% in 1925 to 44½% in 1955.

While certain mach form metals to chang appearance, the hea nace alters the inne changes the proper Advances in this fi largely a 20th centur By 1945 it was possib degree of hardness

Chicago's Merchandise Mart (left), with 4 million sq. ft. of floor space, is the world's largest commercial building. Opened in 1930, it houses wholesale offices with 30,000 employees. Wholesale establishments (including warehouses and storages) more than doubled (to 316,000) since 1929, and employment doubled (to 3.1 million) since 1943.



Empire State Building, tallest in the world, towers 102 stories (1,250 ft.) above Manhattan. Completed in 1931, it is a majestic symbol of millions of office facilities across the nation used to carry out the planning, routing, legal work and record keeping for exchanging goods and services.

Continuous improvements in business machines have increased efficiency in the exchange of goods and services. Writing, reproducing, classifying, selecting, tabulating, filing and indexing machines, save time and labor, simplify mathematical tasks and assure greater accuracy. These business machines have also opened a whole new field of employment to women.

tual usage money is a receipt which we e when we give something up (be it serv- we perform or some specific product) and we use later to exchange for something else.

The "bankers' banks" are the 12 Federal Reserve Banks. They direct an efficient, elastic money and credit flow by centralizing member bank reserves and controlling the interest rate.

Insurance is a tool which enables the losses of the few to be paid for by the many. Premiums collected by insurance companies, like bank deposits, are tools that are invested in productive things. Insurance premiums paid annually reached $29.6 billion in 1958.

ll Economic Gr

al Goods)

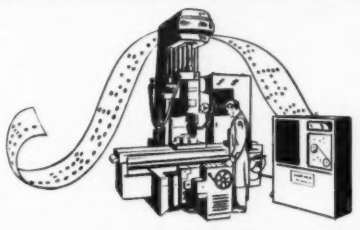
"Tools" are all of the things used by man to convert natural resources into commodities and services.

"Tools" also include all the facilities for conveying and exchanging commodities and services.

47,916 Patents Issued in 1941	42,446 Patents Issued in 1942	33,476 Patents Issued in 1943	31,159 Patents Issued in 1944	29,347 Patents Issued in 1945	24,719 Patents Issued in 1946	22,381 Patents Issued in 1947	28,052 Patents Issued in 1948	39,716 Patents Issued in 1949	47,919 Patents Issued in 1950	48,661 Patents Issued in 1951	46,789 Patents Issued in 1952	43,381 Patents Issued in 1953	36,563 Patents Issued in 1954	33,379 Patents Issued in 1955	49,984 Patents Issued in 1956	45,317 Patents Issued in 1957	50,952 Patents Issued in 1958

"AUTOMATION"* is the word given to the operation of two or more different forms of machines tied together with automatic work transfer mechanisms.

*The word "automation," coined by a Ford Motor Company executive, has replaced the term "transfer machines."



NUMERICAL CONTROL introduced in 1952 is the newest form of tooling. It programs the machine operations from stored data recorded on a tape. Thus more output per man hour is achieved.

The development accurate machine t obsolete those we

American Industria ously retarded by too few and obsole

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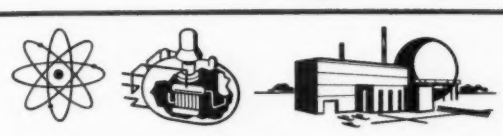
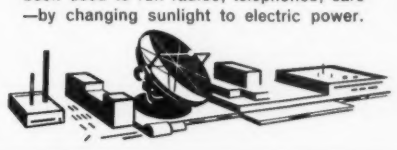


Atomic energy promises abundant power in future. There are 130 utility companies which already have atomic programs. U. S. industry, under government contract, did most of the work to develop atomic power. Industry and government have in operation or planned nearly 300 nuclear reactors.

Solar energy offers many possibilities for the future. Sun sends steady, reliable energy in huge quantities to earth. It already has been used to run radios, telephones, cars —by changing sunlight to electric power.



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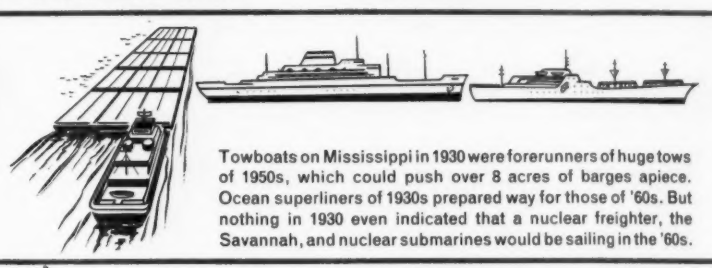
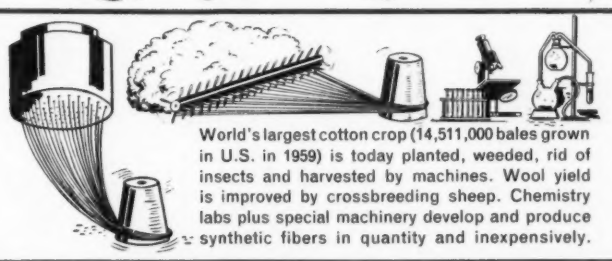
Commerce and industry advance with planes taking people, freight, mail around globe. In October, 1958, first jet appeared. Today jets jam the sky. (Each jet is longer than the original flight of the Wright brothers.) Helicopters are multiplying on routes between cities and suburbs.



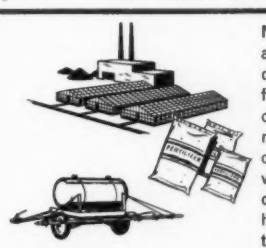
Towboats on Mississippi in 1930 were forerunners of huge tows of 1950s, which could push over 8 acres of barges apiece. Ocean superliners of 1930s prepared way for those of '60s. But nothing in 1930 even indicated that a nuclear freighter, the Savannah, and nuclear submarines would be sailing in the '60s.

In 1900, the avera eled 200 miles a travels 10,000. T has one car and is Not dreamed of in today: 100-m.p. tives, color TV, ra dialing, radiopho

nerican, Clarence Birdseye, launched foods industry. Canning, milling, bak- d from home to mass production as- echnology improves the quality of food nourished on a better diet.

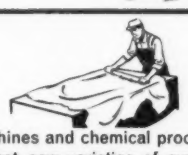


World's largest cotton crop (14,511,000 bales grown in U.S. in 1959) is today planted, weeded, rid of insects and harvested by machines. Wool yield is improved by crossbreeding sheep. Chemistry labs plus special machinery develop and produce synthetic fibers in quantity and inexpensively.

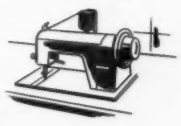


New chemicals (many stemming from 2-4D and DDT) today kill or control bugs, plant diseases, weeds. Weeds are treated before they appear above ground. U.S. chemistry mass produces formerly scarce nitrogen fertilizers. New farm tools include sprayers, spreaders, balers, elevators, greenhouses and even an air conditioner for the tractor driver. Research has brought about the greatest agricultural revolution in history.

Average U.S. fa than a fourth of t but eat more an lies elsewhere wh of their productiv min-enriched, s produced-and- Americans grow pounds heavier a than they did in



New machines and chemical processes are producing vast new varieties of synthetic fabrics. Fabrics of polyvinyl butyral for automotive interiors, furniture and wall coverings look like leather and wipe clean when something is spilled on them.

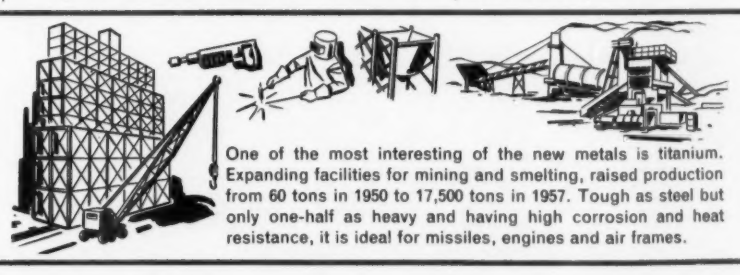


To meet world competition we must greatly increase our tools and technology. Most urgent is greater automation, new cleaning machines for cotton, more man-made fibers and the development of nonwoven fabrics (held together with resins but still capable of being laundered) all to bring better clothes at lower prices.

Japan is moving in automation example . . . one have only 40 t against the usua for a 30,000-sp operation.

, mechanization of operations and large a few of many casting processes intro- . Shell molding, one of the most signif- old limitations on size of castings and s of .004 in. or less. Demands for light, ave brought developments making alu- esium castings competitive with others.

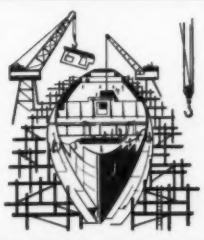
Mechanical methods for blowing, extruding, pressing, drawing, molding, casting and rolling revolutionized glass-making since World War I. Plastics developed during same period. Glassmaking became a billion dollar industry in 1950 ($56.5 million in 1900). Manufacture of plastics rose from 6 million pounds in 1922 to 5 billion pounds in 1959.



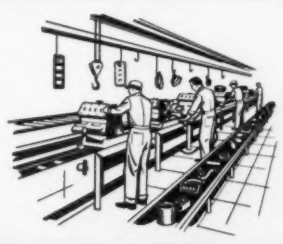
One of the most interesting of the new metals is titanium. Expanding facilities for mining and smelting, raised production from 60 tons in 1950 to 17,500 tons in 1957. Tough as steel but only one-half as heavy and having high corrosion and heat resistance, it is ideal for missiles, engines and air frames.

New and "exoti a prominent pla with ceramics materials, the fu opportunities f better things a

certain machines shape or metals to change their outward rance, the heat-treating fur- alters the inner structure and es the properties of metals. ces in this field have been a 20th century achievement. 5 it was possible to predict the of hardness with accuracy.



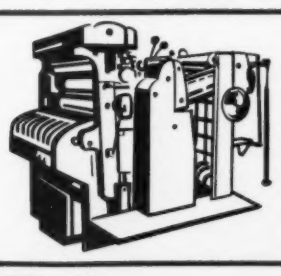
Shipbuilding employs many of man's biggest tools—dry dock scaffolding, cranes and conveyors —to weld, bolt and rivet huge sections together. Some 150 U. S. yards build ships up to 1,000 ft. long, 88,000 tons in weight. A big ship may take 2 million man hours to design, more than a year to build.



An assembly line is a form of automation. Automation now applies to the automatic operation of any process; a machine or string of machines to process materials or parts, process information or an integrated combination of both. Automation, already outstripping predictions of five years ago, is destined to become a giant that reduces man hours of production, material costs, manufacturing costs and scrap losses while improving quality and safety records.

We must have American work per hour. U. behind rising w invested in pla $95 billion is ob manufacturing such as Russia are newer and

mathematical ccuracy. These also opened a ent to women.



Influencing mass audiences, advertising (1) lowers production cost by increasing volume, (2) lowers prices (thus raising living standards) and (3) lowers selling cost. The printed word (newspapers, magazines, direct mail, billboards) accounts for half of expenditures. Newer advertising forms are radio broadcasting (4,431 stations) and TV (652 stations).

The phenomenal expansion of service industries is the result of maintaining our steadily growing supply and variety of capital goods and providing more activities for our increasing leisure time. Employment has more than doubled since 1929. The cost of these services took ⅓ of the family budget by 1950; now takes 40%.

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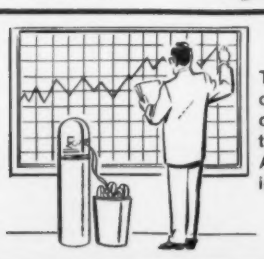
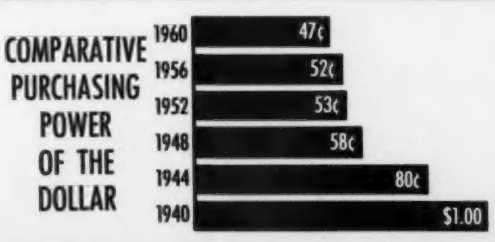
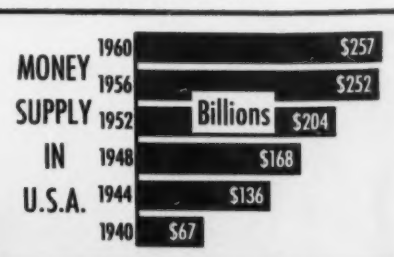


The Stock Exchange is a market place where certificates of ownership representing the tools of production are bought and sold. Today more than fifty million people share the ownership of American corporations through their investment in stocks and bonds listed on the exchanges.





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8	56,810	51,530	47,721	44,899	44,771	43,216	43,452	49,035	48,765	47,916	42,446	33,476	31,159	29,347	24,719	22,381	28,052	39,716	47,919	48,66
Patents Issued in	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	195

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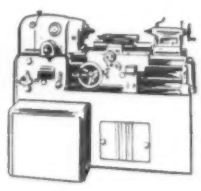
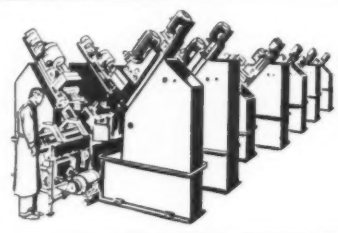


Tungsten carbide cutting tools on automatic machine tools greatly increased productivity.



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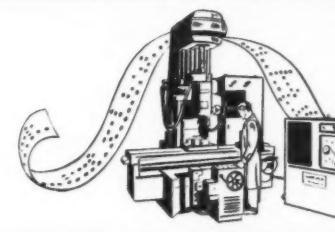
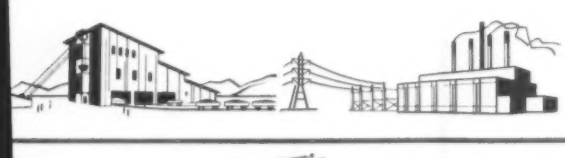
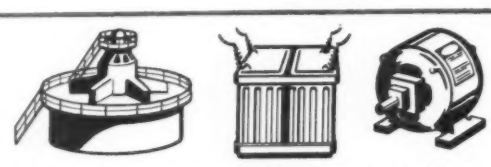


Coal was the fuel that fired the industrial revolution. Today power plants are still the biggest users of coal. It is the fuel the U. S. has the most of. We have enough for the next 100-200 years and we know where and how to get it. Mechanization made low-cost coal mining.





The dynamo changes mechanical power into electrical power. U. S. production went from 91 billion kw hours in 1930 to 724 billion in 1958. Electric motors permit wide application as convenient power packs for most stationary tools.

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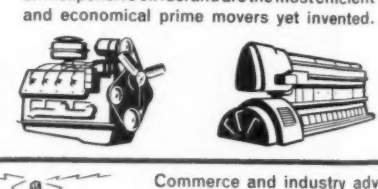

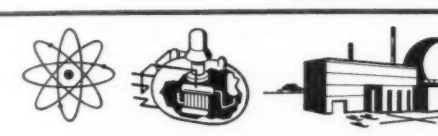

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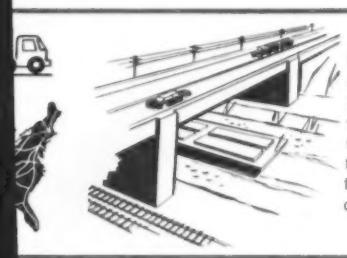
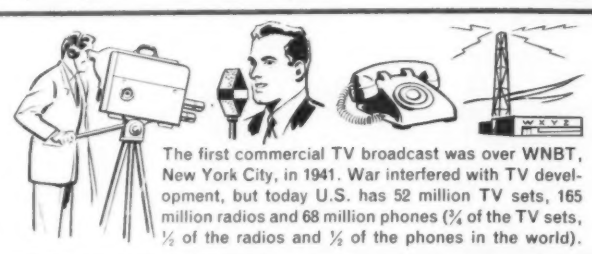


Highways (3½ million miles in 1960, of which half are paved), bridges (vital links in highway system), tunnels, canals, tracks and phone wires are tools that keep U.S. knit together. Road network is so vital that 100,000 miles (4 times world's circumference) is repaired annually.



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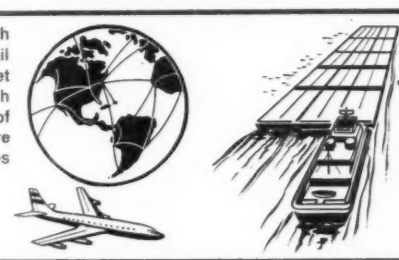
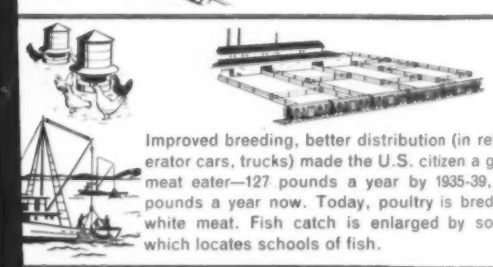
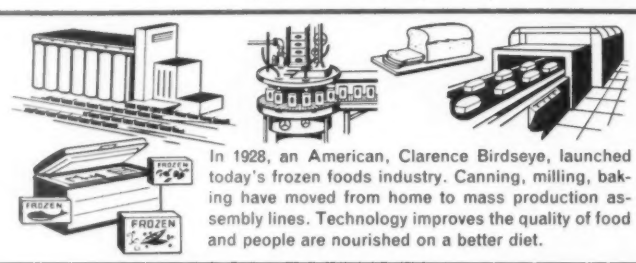
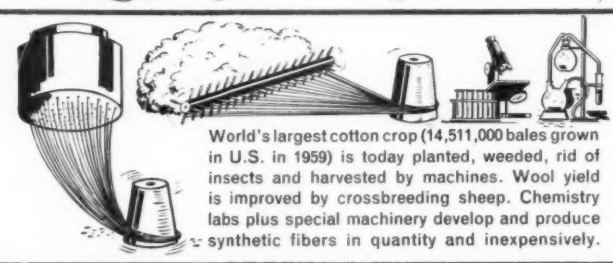




Improved breeding, better distribution (in refrigerator cars, trucks) made the U.S. citizen a great meat eater—127 pounds a year by 1935-39, 159 pounds a year now. Today, poultry is bred for white meat. Fish catch is enlarged by sonar, which locates schools of fish.



In 1928, an American, Clarence Birdseye, launched today's frozen foods industry. Canning, milling, baking have moved from home to mass production assembly lines. Technology improves the quality of food and people are nourished on a better diet.



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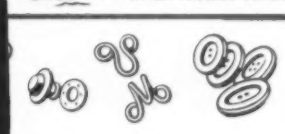

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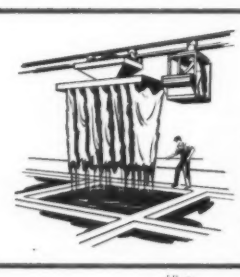
In 1923, 106 pounds of a little-known substance called rayon (man-made silk) were produced. Ingenious special machinery put rayon on its way. Today rayon and other synthetic fibers make up one-fourth of our total textiles.



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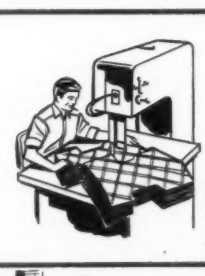

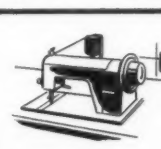

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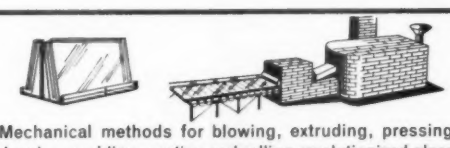

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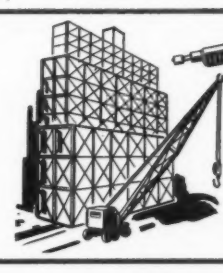

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sets of $37.5 million and 2 million employees, the
dustry's annual production gushed from 209 million
2,500 million barrels between 1910 and 1955. U. S.
oduces nearly half the world's supply for fuels,
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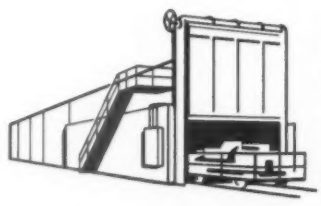
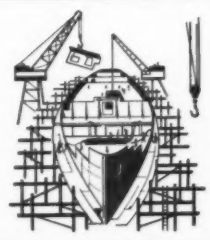
dicines. But expanding world production is shrink-
U. S. share—from 71% in 1925 to 44⅓% in 1955.



While certain machines shape or form metals to change their outward appearance, the heat-treating furnace alters the inner structure and changes the properties of metals. Advances in this field have been largely a 20th century achievement. By 1945 it was possible to predict the degree of hardness with accuracy.



Shipbuilding employs many of man's biggest tools—dry dock scaffolding, cranes and conveyors—to weld, bolt and rivet huge sections together. Some 150 U. S. yards build ships up to 1,000 ft. long, 88,000 tons in weight. A big ship may take 2 million man hours to design, more than a year to build.

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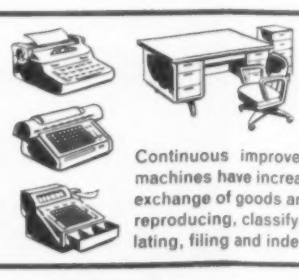
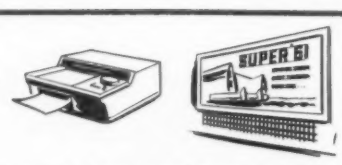
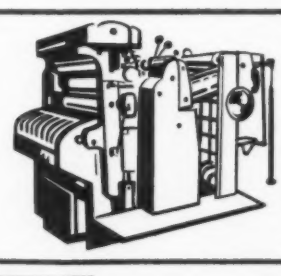


Continuous improvements in business machines have increased efficiency in the exchange of goods and services. Writing, reproducing, classifying, selecting, tabulating, filing and indexing machines, save time and labor, simplify mathematical tasks and assure greater accuracy. These business machines have also opened a whole new field of employment to women.





Influencing mass audiences, advertising (1) lowers production cost by increasing volume, (2) lowers prices (thus raising living standards) and (3) lowers selling cost. The printed word (newspapers, magazines, direct mail, billboards) accounts for half of expenditures. Newer advertising forms are radio broadcasting (4,431 stations) and TV (652 stations).

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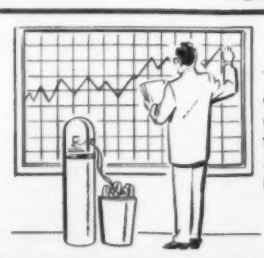
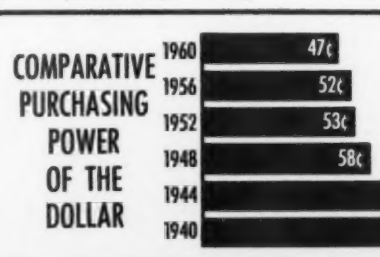
Insurance is a tool which enables the losses of the few to be paid for by the many. Premiums collected by insurance companies, like bank deposits, are tools that are invested in productive things. Insurance premiums paid annually reached $29.6 billion in 1958.



The Stock Exchange is a market place where certificates of ownership representing the tools of production are bought and sold. Today more than fifty million people share the ownership of American corporations through their investment in stocks and bonds listed on the exchanges.



omic Growth

" are all of the things used by man to convert l resources into commodities and services.

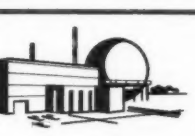
" also include all the facilities for conveying changing commodities and services.

919 ents ued n 50	48,661 Patents Issued in 1951	46,789 Patents Issued in 1952	43,381 Patents Issued in 1953	36,563 Patents Issued in 1954	33,379 Patents Issued in 1955	49,984 Patents Issued in 1956	45,317 Patents Issued in 1957	50,952 Patents Issued in 1958	55,416 Patents Issued in 1959	$10 billion for R & D in 1960

NUMERICAL CONTROL introduced in 1952 is the newest form of tooling. It programs the machine operations from stored data recorded on a tape. Thus more output per man hour is achieved.

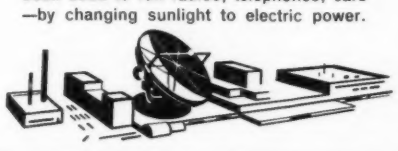
The development of faster, more accurate machine tools continues to obsolete those we have on hand.

American Industrial Progress is seriously retarded by continued use of too few and obsolete machine tools.

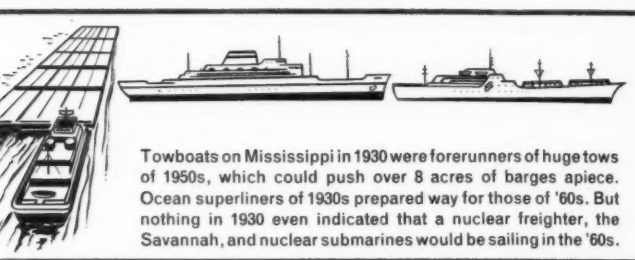


power in future. There eady have atomic pro- ment contract, did most dustry and government 300 nuclear reactors.

Solar energy offers many possibilities for the future. Sun sends steady, reliable energy in huge quantities to earth. It already has been used to run radios, telephones, cars —by changing sunlight to electric power.

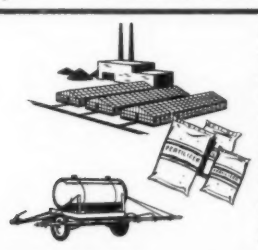


Till 1900, nearly half the work of the U. S. was done by muscles. In most of the world that's still the case. Today, 99% of the work in the U. S. is done by machines and power, 1% by muscle. The work week has shortened from 70 hours to 40. The biggest beneficiary is the average man. He used to do most of that muscular drudgery.



Towboats on Mississippi in 1930 were forerunners of huge tows of 1950s, which could push over 8 acres of barges apiece. Ocean superliners of 1930s prepared way for those of '60s. But nothing in 1930 even indicated that a nuclear freighter, the Savannah, and nuclear submarines would be sailing in the '60s.

In 1900, the average American traveled 200 miles a year. Today he travels 10,000. The average family has one car and is likely to have two. Not dreamed of in 1900, but common today: 100-m.p.h. diesel locomotives, color TV, radar, long-distance dialing, radiophotos.



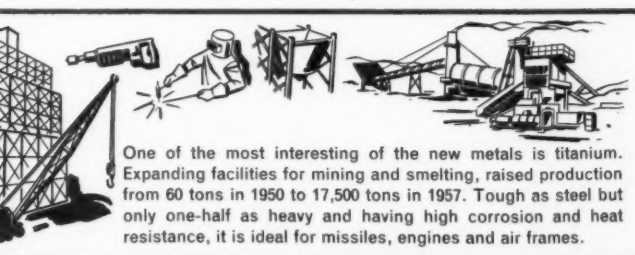
New chemicals (many stemming from 2-4D and DDT) today kill or control bugs, plant diseases, weeds. Weeds are treated before they appear above ground. U.S. chemistry mass produces formerly scarce nitrogen fertilizers. New farm tools include sprayers, spreaders, balers, elevators, greenhouses and even an air conditioner for the tractor driver. Research has brought about the greatest agricultural revolution in history.

Average U.S. families spend less than a fourth of their income on food but eat more and better than families elsewhere whose food takes 60% of their productive efforts. With vitamin-enriched, scientifically mass-produced-and-distributed foods, Americans grow inches taller, and pounds heavier and live years longer than they did in 1900.

t world competition we must greatly e our tools and technology. Most is greater automation, new clean- chines for cotton, more man-made

fibers and the development of nonwoven fabrics (held together with resins but still capable of being laundered) all to bring better clothes at lower prices.

Japan is moving ahead of the world in automation for textiles: For example . . . one automated mill will have only 40 to 50 employees as against the usual 400 to 450 required for a 30,000-spindle cotton yarn operation.



One of the most interesting of the new metals is titanium. Expanding facilities for mining and smelting, raised production from 60 tons in 1950 to 17,500 tons in 1957. Tough as steel but only one-half as heavy and having high corrosion and heat resistance, it is ideal for missiles, engines and air frames.

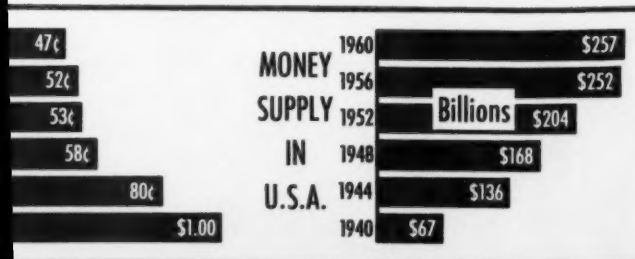
New and "exotic" metals are taking a prominent place in industry. And with ceramics and other man-made materials, the future offers enormous opportunities for making more and better things at lower cost.

An assembly line is a form of automation. Automation now applies to the automatic operation of any process; a machine or string of machines to process materials or parts, process information or an integrated combination of both. Automation, already outstripping predictions of five years ago, is destined to become a giant that reduces man hours of production, material costs, manufacturing costs and scrap losses while improving quality and safety records.

We must have more facilities for American workers to produce more per hour. U. S. productivity lags behind rising wages. Of $300 billion invested in plants and equipment, $95 billion is obsolete, whereas some manufacturing facilities in nations such as Russia, Japan and Germany are newer and more productive.

The phenomenal expansion of service industries is the result of maintaining our steadily growing supply and variety of capital goods and providing more activities for our increasing leisure time. Employment has more than doubled since 1929. The cost of these services took ⅓ of the family budget by 1950; now takes 40%.

With freedom of choice in the market place, the customer is always king.



Unhappily money does not retain constant value. If the supply increases faster than production, purchasing power goes down (this fact is demonstrated by the charts on the left.) Value is retained when the money supply conforms to production, when government builds confidence by staying within its budget and when money is tied to the gold standard.

U. S. population has grown explosively—9 million added in the 1930s, 19 million added in the '40s, 30 million added in the '50s. That rate will add 45 million in the '60s—to a total of 219 million by 1970.

Providing tools of production to meet the needs of our growing population requires an ever increasing investment in new plants and equipment—from $20 billion annually in 1940 to $70 billion, 1970.

Population is expanding rapidly. By 1970 it will reach 219 million. The number of youngsters seeking jobs will rise sharply after 1960. Every week 25,000 new jobs must be found.

Obviously this will require enormous investment in "tools" (70 billion dollars worth per year by 1970). With the march of science, invention, improved technology and greater specialization, the number of dollars necessary to create a job has grown. Relying upon American business firms, guided by competitive free enterprise, we have been able to acquire the necessary accumulation of "tools." But in this next ten-year period, intense foreign competition plus growing inefficiency in some segments of labor and increasing handicaps imposed by government, cast a doubt on our ability to have sufficient economic growth.

Whether our economy will be able to grow and prosper, or stagnate and bog down, depends upon the political climate, legislation, taxation, fiscal and monetary policy, foreign trade and international regulations. There are 4,500,000 separate businesses (outside of agriculture) that are the centers of initiative to expand our economy. These businessmen must be regarded as agents who perform the functions of assembling manpower, materials and machinery and organizing them into a productive unit, catering to the free choices of customers. Whether they can obtain enough new investment capital for American needs depends upon immediate correction of our faults.

ACKNOWLEDGMENTS

Appreciation is extended to the following for assistance in the preparation of this chart: American Trucking Associations, Inc., Washington, D.C.; Chamber of Commerce of the United States, Washington, D.C.; Machinery and Allied Products Institute, Washington, D.C.; National Association of Manufacturers, New York; National Science Foundation, Washington, D.C.; The American Economic Foundation, New York; National Bureau of Economic Research, New York; "History of American Technology" by John W. Oliver; "The Iron Age—100th Anniversary Issue," June, 1955, Vol. 175, No. 27; Encyclopaedia Britannica; The World Book Encyclopedia.

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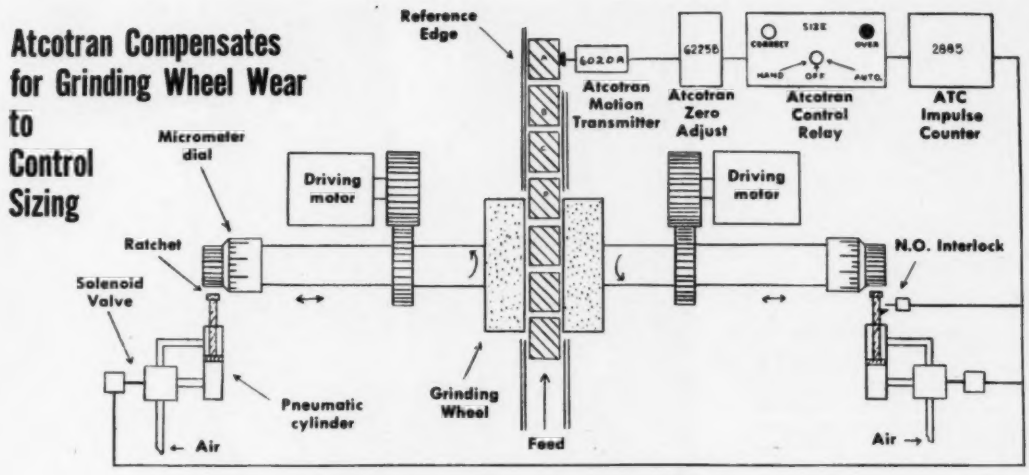

Fig. 1 A schematic of an Atcotran electronic system installed on a Besly-Welles grinder.

Compensate for Wheel Wear . . . Automatically

AN ELECTRONIC CONTROL SYSTEM INSTALLED on a Besly-Welles grinder has reduced labor cost by 50%, according to Mr. Norman Pfeiffer of Shiller and Pfeiffer Co., Philadelphia, a general production machine shop with facilities to handle work from 2″ to 5′ dia. This system has required little maintenance — only one electron tube has been replaced in 4 yrs of operation. Rejects due to human error have been eliminated and the initial cost has been returned many times over through increased production.

Developed by Automatic Timing & Controls, Inc., King of Prussia, Pa., the control system replaces previous "hit or miss" methods with proven reliability. Tolerances of 0.001 on production grinding jobs are automatic and routine.

In this application, ring seals for pillow blocks are fed between two contra-rotating wheels that have been positioned by micrometer dials. As the grinding proceeds, grinding wheel wear results in the production of oversized parts. Formerly an attendant was required to measure each workpiece periodically, then set micrometer dials by hand to compensate for grinding wheel wear.

Now the workpiece passes through a gage equipped with an "Atcotran" control amplifier, which energizes solenoid valves

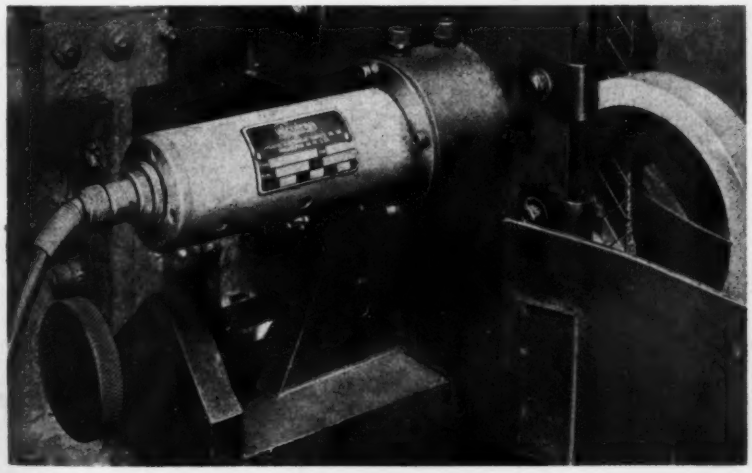

Fig. 2 Atcotran motion transmitter maintains tolerances by detecting oversized part due to grinding wheel wear. Accuracy of control is limited only by the equipment on which it is installed.

Fig. 3 Atcotran installation requires only one man for completely controlled operation. Lights on the control panel indicate under or oversize conditions. A switch provides either manual or completely automatic performance.

positioned to admit air to pneumatic cylinders. The cylinders drive ratchets fitted to the micrometer dials that correct for wheel wear automatically.

Control panels positioned close to the machine house the relay, impulse counter and zero adjust. Pilot-lights on the control panel indicate "correct" and "oversize" conditions. Also included in the package is a control switch to effect manual or completely automatic system performance. A zero adjustment provides a reference for the tolerance to be measured by the motion transmitter.

This system, comprised essentially of relatively standard hardware, has been accepted as the simplest for automatic grinding operations.

Temperature and humidity have little effect on the accuracy of the system. The ability to transmit the signal from the work area motion transmitter to the remote control amplifier makes possible repeat accuracies in the neighborhood of 0.0002. However, the accuracy is determined principally by the grinding equipment rather than the "Atcotran." end

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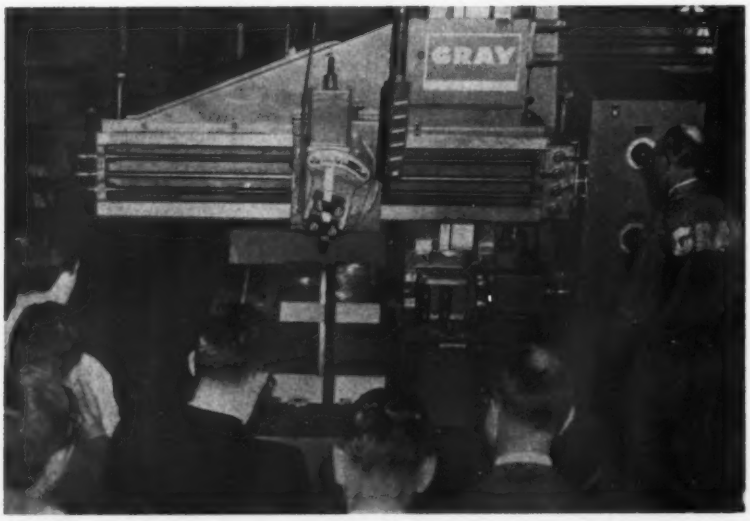
Foreign Competition And The American Machine



With wages as much as 75% lower than wages here, coupled with lower materials cost (the same old problem) . . .

To stay in competition U.S. manufacturers are forced to produce better machines — even at lower cost. To accomplish this, they must attach new value and importance to ingenuity in the design, engineering and the production of machine tools.

The G. A. Gray Co., Cincinnati, Ohio, a leader in the field of giant planers, horizontal boring mills and planer type milling machines, recently introduced a new, low-priced, compact heavy duty planer, designed for fast carbide planing. It's called the Flying Scot.

Complete information is available by writing the G. A. Gray Co., Cincinnati 7, Ohio, Dept. Q.

Definitely "in" . . . magnesium tooling plate

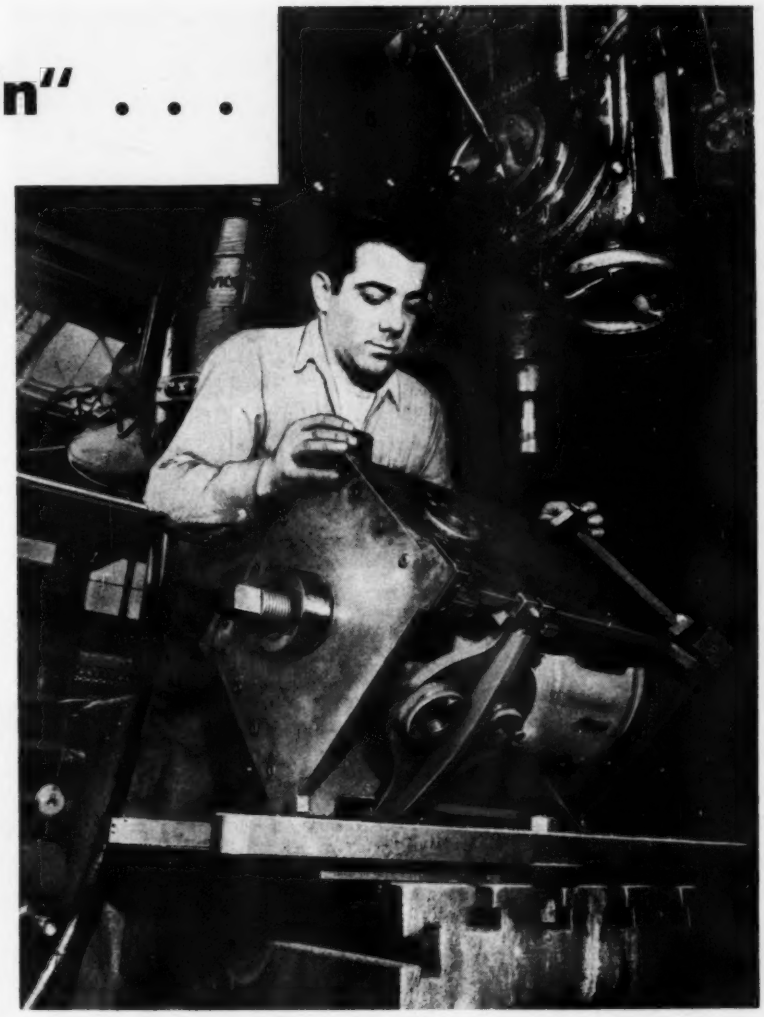


Fig. 1 Magnesium tooling plate in this tumble jig resulted in a saving of $3.08 on every part processed in it. When made of other material, the jig could only be turned with the aid of a hoist.

AFTER SEVEN YEARS ON THE MARKET, magnesium tooling plate is an established tooling material. The product is being used in a score of general tooling categories by a growing number of industries.

Because of its long familiarity with magnesium as an aircraft metal, the aircraft industry has been the first to use magnesium tooling plate on a large scale, but its use in several other industries — automotive, electronic and appliance — is spreading. A factor in the increased consumption of this product has been the establishment of local distribution outlets in major industrial centers.

The chief virtues of magnesium tooling plate are its light weight, its as-delivered flatness and relative price.

Shops that formerly required lift trucks or hoists to maneuver jigs and fixtures of heavier materials have been able to dispense with them by converting tooling to magnesium. Magnesium is only 66% as heavy as aluminum, and 25% as heavy as steel, and in tooling it usually can be substituted for these metals gage for gage. Even small tools can benefit from the weight-saving inherent in magnesium, if worker fatigue is a factor.

In applications where stiffness is all-important, magnesium is definitely useful. Since stiffness varies as the cube of thickness and weight varies only as the first power, slight increases in section thickness can produce very rigid tooling at a distinct weight advantage, compared to other tooling metals.

Magnesium tooling plate is first rolled, then anneal-flattened to tolerances adequate for at least 90% of all tooling uses. Specific flatness tolerances are guaranteed even for gages less than 1". This means that the user can begin fabricating tools from magnesium tooling plate immediately upon delivery of the material; no grinding is necessary.

In thicknesses of 0.250 to 1.000 inch, guaranteed flatness tolerances are 0.005 in any 1 ft and 0.015 in any 6 ft; typicals are 0.003 in any 1 ft and 0.007 in any 6 ft. For thicknesses of 1.001 to 3.500, guaranteed tolerances are 0.010 in any 1 ft and 0.020 in any 6 ft; the typicals, 0.005 in any 1 ft and 0.010 in any 6 ft.

This plate has been furnished in pieces up to 2100 lbs and up to 30 ft long. Mill standard sizes are 48 x 96", 48 x 144", 60 x 144" and 72 x 144", depending on gage.

Because of magnesium's lower density, price comparisons with other materials should be made on a volume, rather than pound, basis.

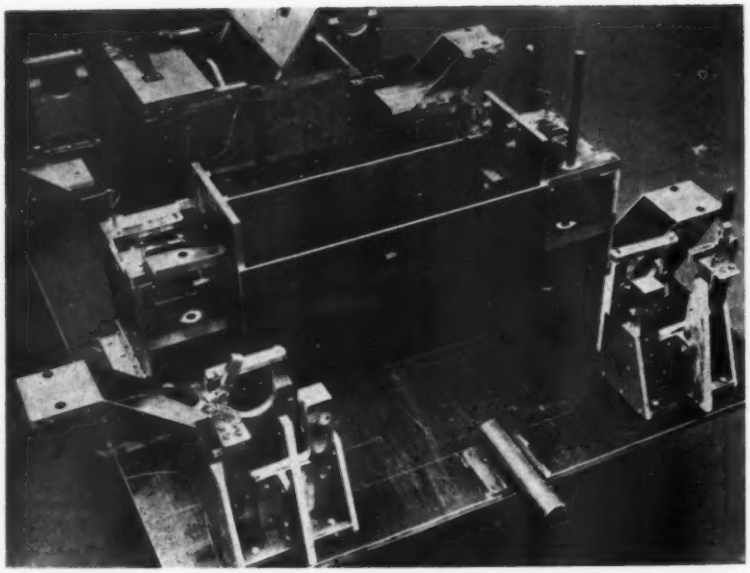


Fig. 2 This jig is used to drill two assemblies simultaneously. It is large and fabricated entirely of magnesium tooling plate. The heaviest gage is 1".

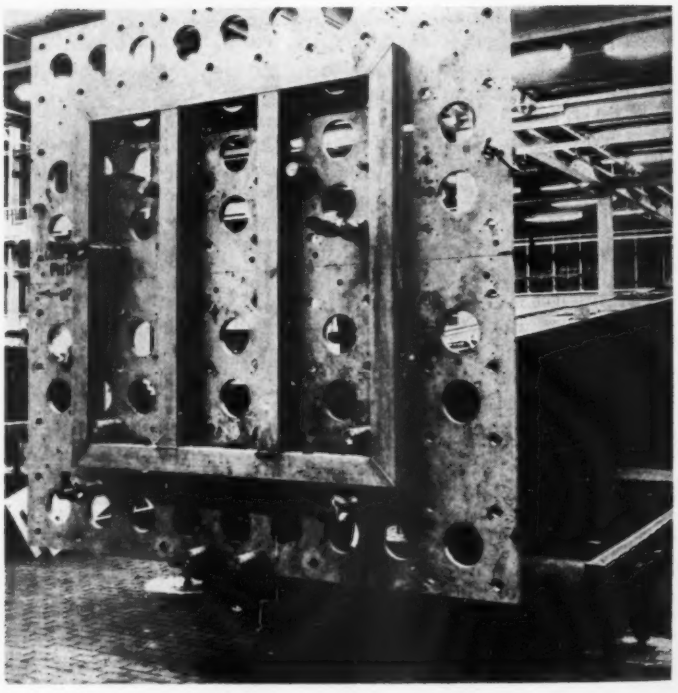


Fig. 3 This master optical tool was fabricated from 1½" plate and 4" square magnesium tube. Optical instruments are inserted in the small holes for aligning station contour points on an aircraft fuselage. Large holes are for even more weight reduction.

Comparing equivalent volumes, magnesium tooling plate costs average 22% less than other lightweight tooling metals of comparable flatness.

There are other advantages: because there is no tendency to tear or drag, magnesium is more easily machined than any other common metal. Magnesium tooling plate has been chosen for many jobs where the time element required that machining be accomplished as rapidly as possible.

The product's dimensional stability is excellent, since annealflattening removes residual stresses created by the rolling process. Also, using commercial methods, magnesium tooling plate is readily welded. Weld efficiencies of 95% are common. However, stresses set up during welding are often severe enough to cause cracking. To prevent cracking, the welded parts should be stress relieved at 500°F for 15 min in clamping plates. Warping can be prevented by clamping during welding.

Magnesium's ability to dampen vibration has led to its extensive use in vibration test fixtures. Such fixtures do not go into resonance

Fig. 4 Jig borer head is fabricated from magnesium for easier lifting. Worker can insert it easily with one hand. With heads being changed frequently, this weight saving reduces fatigue considerably.

Fig. 5 Automotive checking fixture gages the shims between frame and body. It weighs 270 lbs, of which 230 lbs is magnesium tooling plate and channel. Other materials could weigh 2500 lbs.

Fig. 6 The body of this form milling cutter is magnesium. It is used to shape the face of a radar reflector. It is about 24" in length. Magnesium was chosen for its machinability and vibration damping capacity, which greatly reduces chatter.

before the test unit, so spurious vibrations do not complicate results. A leading aircraft and missile manufacturer now uses magnesium tooling plate almost exclusively for vibration testing equipment.

Typical mechanical property ranges for all gages of magnesium tooling plate are: tensile strength, 35 thousand psi; tensile yield strength, 19 thousand psi; compressive yield strength, 12 thousand psi; and elongation in 2" is 10%.

In addition to vibration testing fixtures, magnesium tooling plate is established in these general tooling categories: assembly jigs and fixtures, checking fixtures and gages, drill jigs, hydropress form blocks, layout tables, location jigs, master plasters, master tools, milling fixtures, plastic molds, profiling templates, project plates for skin mills, routing blocks and fixtures, rubber molds, spinning forms, stretch press forms, table tops, vacuum chucks and welding fixtures. A few examples are shown in the accompanying pictures.

Since mid-1954, when the product was first introduced, The Dow Metal Products Co., Midland, Mich., says magnesium tooling plate sales have climbed close to the 1.5 million lb/yr mark. Magnesium tooling plate now accounts for an estimated 10% of the lightweight tooling market nationwide. It is used by one aircraft company for about 25% of its tooling, and it continues to make inroads on both mild steel and aluminum. end

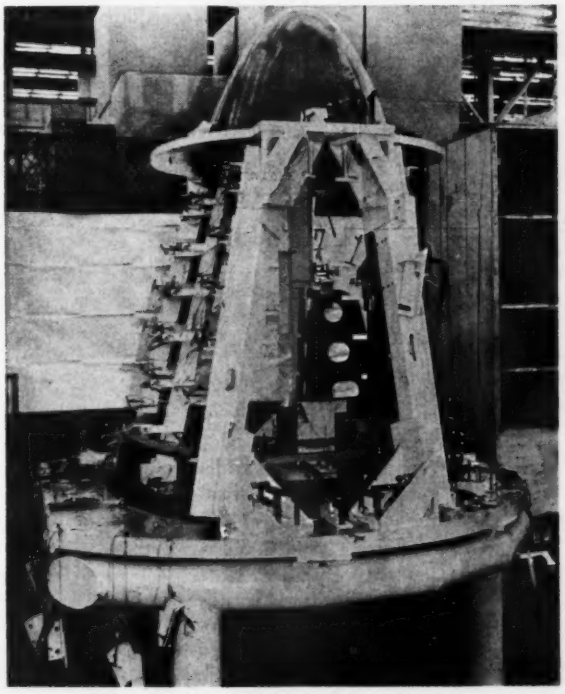
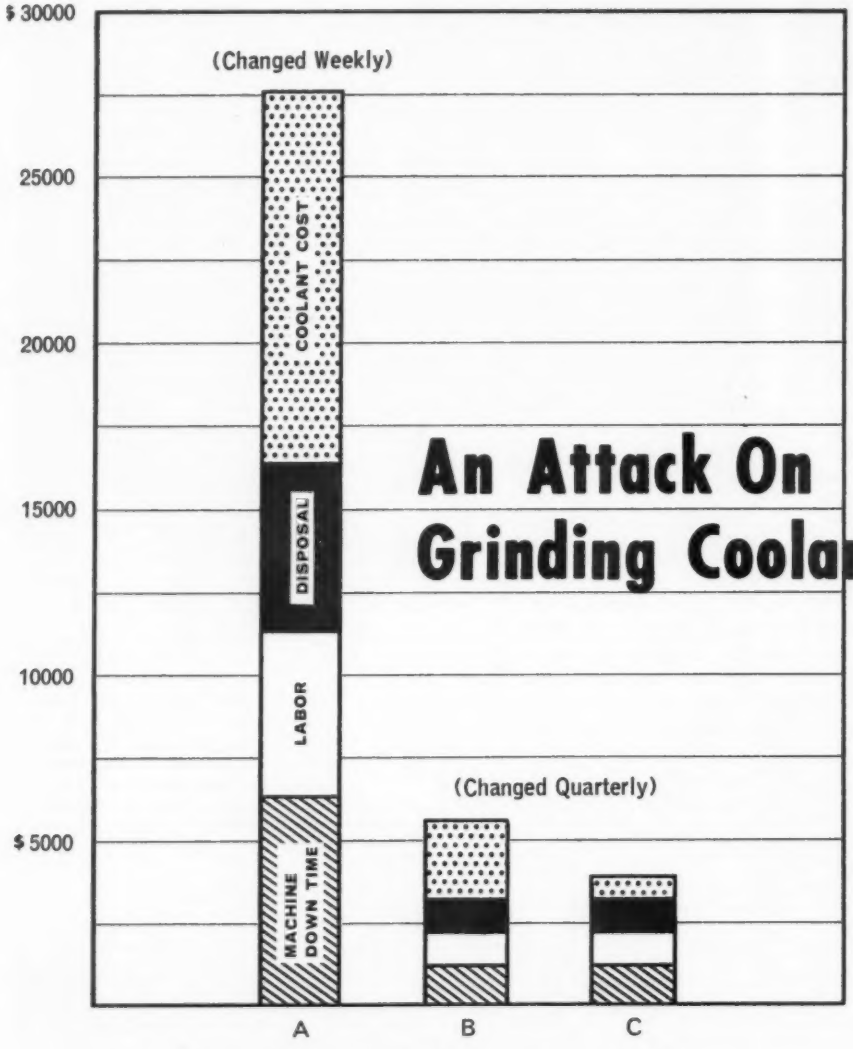


Fig. 7 Vertical supports and upper plate of this nose cone assembly jig were fabricated from magnesium tooling plate and square tube for lightness and dimensional stability.

An Attack On Grinding Coolant Spoilage

by Lawrence Curran
Assistant Editor



ANNUAL CUTTING FLUID COSTS FOR 24 MACHINES

A — Total costs prior to coolant treatment.
B — After treatment.
C — After treatment and less expensive concentrate.

GOOD HOUSEKEEPING and chemical control have been advocated as an effective team to prevent excessive metalworking dollars from going down the drain with spoiled grinding fluids.

According to James Landes, technical specialist at Elanco Products Co., "... if you drop iron filings into a glass of fresh milk, they will settle to the bottom of the glass. But if you drop the filings into a glass of almost soured milk, containing millions of slimy bacteria, the filings will not settle." Says Landes, "If this occurs in an emulsion sump, and slime and filings are pumped over a grinding wheel, . . . the wheel will require frequent dressing. The pores will become plugged and inefficiency results."

Elanco Products Co. is the division of Eli Lilly & Co. which markets the Indianapolis, Ind., firm's industrial products. Elanco recently sponsored a symposium on the bacteriology of coolants at the University of Toledo, Toledo, Ohio. Besides Mr. Landes, principals in the discussion were a Toledo dermatologist and an assistant professor in the university's biology department.

Landes used the "glass of milk" analogy to illustrate a case history

on how the elimination of coolant slime caused by bacteria led to tangible profits for the Pratt & Whitney Aircraft Div., United Aircraft Corp., East Hartford, Conn.

On four complicated grinding jobs, P&W had been using a rouge stick to obtain a 4 to 6 rms finish, and the maximum pieces per wheel dress was 27. To test Elanco's newly-developed bacteria inhibitor, Elcide 75 the concentrate was mixed with a standard duty soluble oil at a ratio of 40 to 1. The 4 rms finish was easily obtained without changing grinding setup, and the pieces per wheel dress were reportedly increased to 100.

But a chemical bacteria "watchdog" in the coolant may go for naught if operators aren't bacteria conscious away from the machine. This is where the dermatologist enters in industry's fight to save money by preventing excessive machine downtime caused by frequent operator visits to the infirmary.

Protecting the Skin

Dr. Jerome Kimmelman delivered some valuable tips at the symposium, aimed at lessening the operator's susceptibility to skin irritations. He quickly dismissed the old wives' tale that cleaning the skin with oil will afford protection from dermatitis. He cautioned that mineral oil and other hydrocarbons cause defatting, which leads to an increase in the thickness of the skin's outer layers.

While a "tough hide" may seem to be desirable for a machine operator, the condition usually causes the outer skin layers to crack because they aren't as pliable as they should be. "With this fissuring and cracking," says Dr. Kimmelman, "you have lost the normal protective mantle . . . the skin has, and therefore you are open to infection."

His more pertinent recommendations to prevent the development of skin diseases were these:

1) A worker should never be permitted to clean his hands in kerosene or gasoline, as these produce "a great deal of damage to the skin."

2) Adequate washing facilities should be provided, and soaps containing a disinfectant should be used. Dr. Kimmelman mentioned Dial and Lifebuoy as meeting this requirement.

3) Clean work clothes should be stressed and enforced.

4) Machines should be kept free of bacteria-promoting dirty oils and grease.

5) Oil coolant used should be changed at least once a week.

Landes would probably take issue with Dr. Kimmelman on this last point. Elanco recommends a 13 wk life for Elcide 75 treated coolant, based on field test information gathered at Pratt & Whitney, and the grinding machine division of Norton Co., Worcester, Mass.

Long Life Slashes Costs

This testing led to P&W's use of Elcide 75 treated coolant in 624 machines, most of them grinders, and engineers at the East Hartford plant are exploring the feasibility of extending the coolant change schedule to 22 wks.

According to Landes, there are four areas where chemical bacteria control can appreciably reduce costs — machine downtime, labor, disposal, and coolant cost. He cited one case in which a plant spent $27,000 in one year to keep usable coolant in 24 machines. (See chart) Coolant was changed once a week. Only about 40% of the cost went for concentrated coolant. The other 60% broke down into $5000 for used coolant disposal, $5000 for labor to change coolant in the machines, and $6000 for machine downtime.

This plant reportedly cut its coolant cost to $5000 after adopting the Elanco bacteria inhibitor, since they needed to change coolant just 10 times a year instead of 52 times.

The symposium's purpose was not to indict the major manufacturers of cutting and grinding fluids as menaces to the health of machine operators. On the contrary, an Eli Lilly & Co. researcher has pointed out that "The metalworking concentrates, as supplied by the manufacturer, are generally free of bacterial contamination. It is only after these materials are diluted with water by the user that . . . microbiological deterioration takes place."

Dilution Recommendations

Elanco's recommended dilution for Elcide 75 is 1 oz for each 4 gal of mixed emulsion, or 1 gal per 512 gal of emulsion. The firm describes the concentrate as a clear, brown watery solution with practically no odor. They say that skin contact at the recommended dilutions is harmless, but that Elcide 75 concentrate should be handled like any caustic material.

It contains two bacteria-inhibiting agents, thimerosal and sodium o-phenylphenate. The former ingredient has been offered for many years by Eli Lilly & Co. under the tradename "merthiolate," but it is 20 times more dilute in Elcide 75 than it is as a medication.

This chemical approach, combined with a tightening of cleanliness standards, can prove that Jim Landes is right when he says "Control bacteria, and considerable money can be saved."

Extra copies of this article are available while supply lasts. Write Tooling & Production Magazine 1975 Lee Road, Cleveland 18.

Grinding Do's, Don't's

The three most common improper practices are: attempting to remove too much metal at one pass, using the improper grade wheel, or grinding with an improperly dressed wheel which tends to "load up." One or a combination of these conditions can result in a burnishing rather than a grinding action. This generates a higher than normal amount of heat, causing the surface layer of the tool to instantaneously heat and then cool as the wheel is presented and then withdrawn. The resulting rapid expansion and contraction of the metal generates high surface stresses which frequently progress into cracks. The foregoing was extracted from Landis Machine Company's "Thread Tips."

Machinery Trade-In

. . . a "first" for the industry is expected to "up-grade" manufacturing facilities throughout the country.

AT A RECENT BUSINESS LUNCHEON, Paul N. Stanton, a Pratt & Whitney Co. vice president, announced a new plan to be carried out through their new corporate unit, Machinery Trading Corporation. MTC, a unit of the parent company, will have facilities to warehouse, recondition and resell machines taken in trade on the purchase of new Pratt & Whitney machinery. The plan proceeds on the premise that more companies would purchase new equipment to maintain an optimum competitive position if it were easier for them to do so. It's designed to solve write-off complications and the problems of disposing of old machinery. This "one stop service" should be attractive, since P&W offers such a variety of new machinery.

Through the plan, MTC will accept used machinery that has re-sale value, and Pratt & Whitney will allow MTC's appraisal price toward the purchase of new P & W equipment.

It was pointed out that more than 60% of industry's machine tools are more than 10 yrs old. But, the true criterion is the comparative efficiency or capability of a machine.

A machine which may no longer be of value to one manufacturer from an efficiency standpoint may, due to entirely different circumstances, be of tremendous value to another. This "up-grade" cycle will work like this: the giants and others who require the ultimate for long production runs, or precision machining, install new equipment and trade-in surplus machines. The segments of industry dealing in shorter runs, or those with limited capital, can still modernize by buying good used machinery. Their trade-in equipment is available to a still different level that needs better machines than those it has.

With many companies it will not be as much a matter of modernizing as it will be purchasing machines better suited to their manufacturing needs today, which could easily be different from those of yesterday—or tomorrow.

Frank Reilly, vice president of the trading unit, says they will also purchase outright, used equipment other than what they take in trade. In this way they can maintain a balanced inventory to satisfy all needs. end

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Giant Lathe Designed For Maximum Rigidity

Welded steel and modular construction feature the largest and latest of the Clearing "Blue Chip" line of lathes. Delivering 75 hp through the headstock at the lowest speed, the giant lathe can turn work up to 40″ dia or up to 50′ long. Spindle speeds range up to 200 rpm.

All important assemblies and components are of unitized design, permitting their ready removal and replacement to minimize downtime. This concept applies all the way from the main drive to the hardened and precision ground alloy steel ways.

The complete design is aimed at achieving maximum rigidity without sacrifice of flexibility and ease of maintenance. The headstock is a completely independent unit built right down to the floor. The bed is flange mounted to the headstock, permitting substitution of a longer or shorter bed.

Headstock, carriages, and tailstock can be independently controlled, but headstock operation also can be controlled from the carriage. From this point, the operator has all essential controls within easy reach without walking.

Further information on this and other lathes in the Blue Chip line can be obtained from Clearing Div. of U.S. Industries, Inc., 6499 W. 65th St., Chicago 38, or Circle Inform-A-Gram No. D2.

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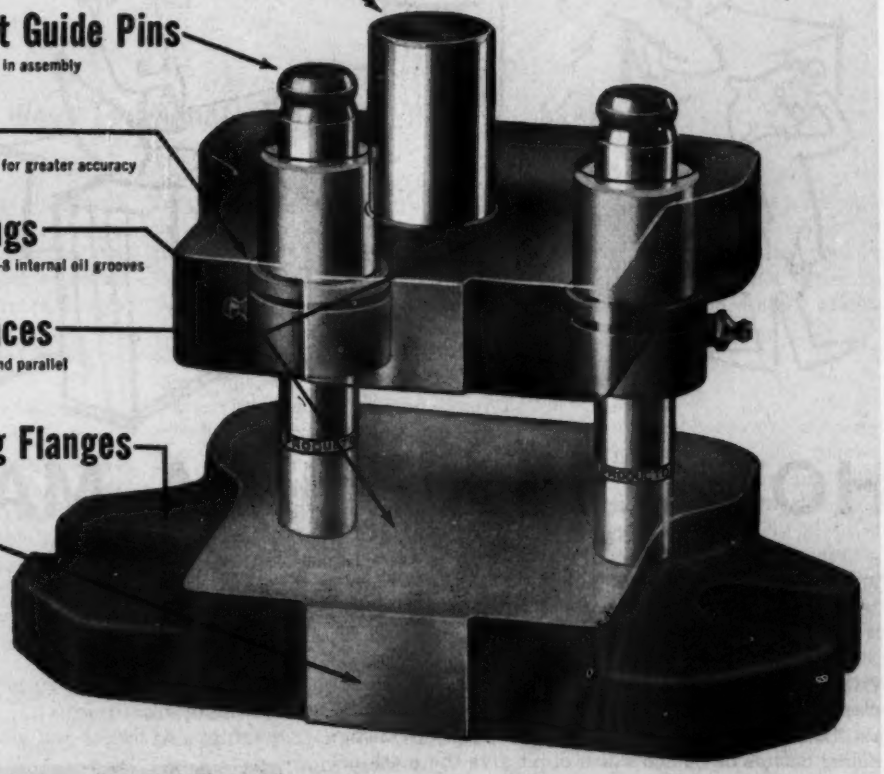

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- **Bushings** — Full-length bearing surfaces for greater accuracy
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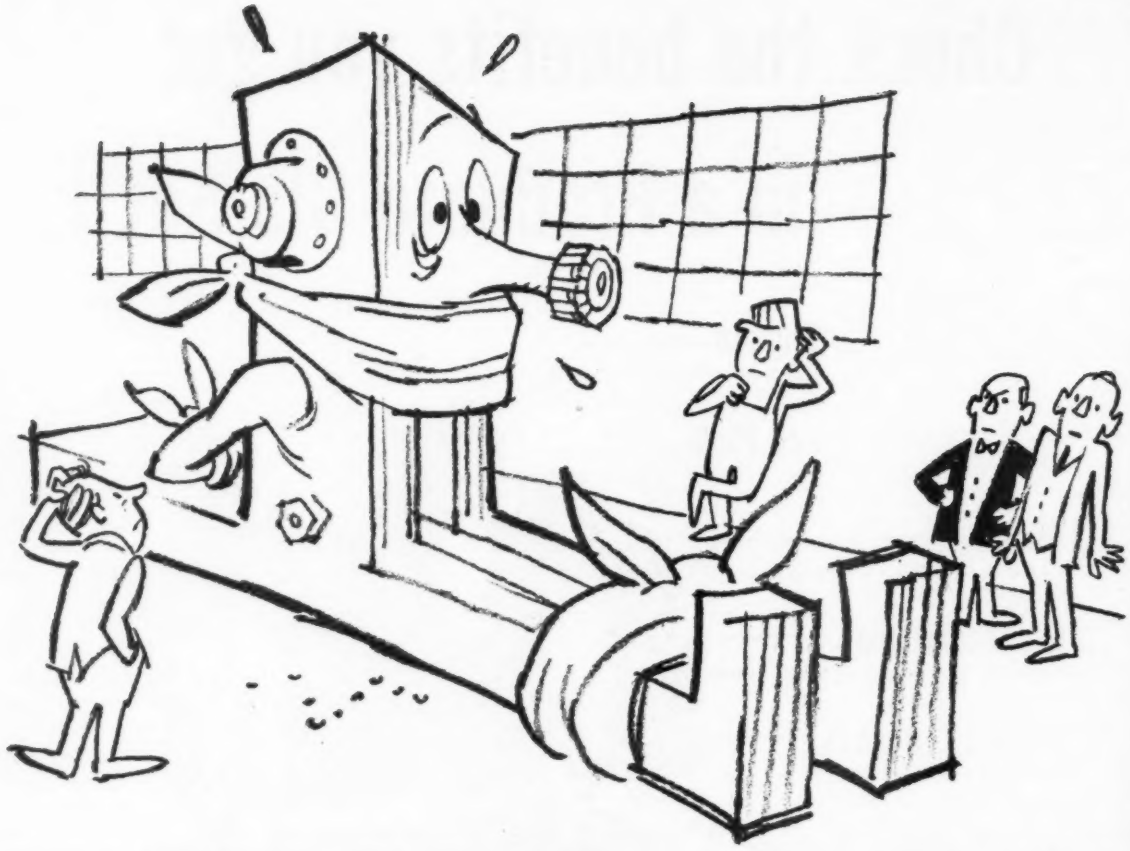

HOW TO TIE-UP A MACHINE INVESTMENT

without getting caught. It's easy, especially if it's not intentional, to make a capital investment almost helpless. Lots of people are doing it today simply by using milling cutters or blades which don't give the machine a chance to come up to its capability.

Sometimes this process is carried on under the name of "cost reduction." Blades are used which have a small per-unit price tag. But, the fallacy here is that the annual expenditure may mount up to a large percentage of the total cost of the machine without getting the performance required for profitable operation.

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CIRCLE INFORM-A-GRAM KEY NO. 58

Machine Replacement For The Shop Manager

by Baxter T. Fullerton
Mr. Fullerton is Director of Marketing Services, The Warner & Swasey Company, Cleveland, Ohio.

Chapter III - Two Ways To Estimate Deterioration

THE SUCCESS of any replacement calculation, whether it's a few rough figures on the back of an old envelope or the most complex and sophisticated of replacement formulas, rests primarily with the estimate of the effect of wear on the old machine.

We can measure fairly accurately the savings to be had because the new machine is of a better design, (Chapter II), but how well can we measure the savings solely attributable to the new machine being new? It is in the measurement of deterioration that the present use of replacement calculations leaves so much to be desired.

How have we been attempting to measure deterioration? Usually, in three ways, by measuring "scrap," "maintenance," and "downtime." Frequently, these three factors come nowhere near telling the full story. We're kidding ourselves if we think that they really explain what goes on in the average machine shop as a machine tool ages.

Scrap

Let's face it. Operators frequently turn out very little more scrap on old machines than they do on new ones. Rather than turn out scrap, the operator of an old machine leaves a little more material on the piece in order to make sure it doesn't become undersize, or he takes more time and care on the machine to make sure it holds size. He checks more of the pieces before he takes them from the chuck, and uses a file to come to size or to take out taper. More important, and this will be discussed later, the foreman doesn't schedule the close tolerance jobs over the old machine.

In practice, the only time scrap becomes important is when the old machine is automatic to the point that the operator has little control over setup or operation, and when the machine is still being asked to do the same caliber of work it was capable of brand new. Then the cost of scrap rings out loud and clear, but in other cases let's admit that it's not the problem we sometimes make it.

Maintenance

Maintenance is much the same story. We pay lip service to the tremendous savings in maintenance that could come from buying new machine tools to replace old clunkers, but sometimes the new machines require more maintenance than the old ones! Modern machine tools are more complicated, and it's really to be expected that they will require more maintenance. For every old machine tool with annual maintenance bills in four figures there are dozens of machines, worn to the point of replacement, with a maintenance cost of only one or two hundred dollars a year — and two hundred dollars is not often significant in replacement calculations.

Downtime

Downtime becomes a severe problem only when the machine that is down is in an integrated production line, or when the machine is a bottleneck in plant capacity. More often than not, although it is annoying and inconvenient to have a machine down, it is not a critical problem. If the old machine is down for a week, the operator doesn't stand there doing nothing; he is put on some other job, so that downtime is important only if you're straining for every ounce of production. This is a figure that rarely appears in a calculation for general purpose machine tools.

If scrap, maintenance and downtime are relatively unimportant in many replacement calculations, does this mean that deterioration has little effect? Certainly not. It means that there is more to deterioration than these three factors can measure.

What is deterioration? It is 101 little things that almost defy measurement! Here are a few of them:

- The operator leaves more stock on every piece. "It's

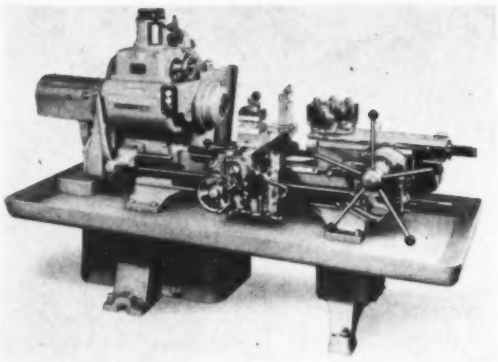


Fig. 1 1946 model turret lathe.

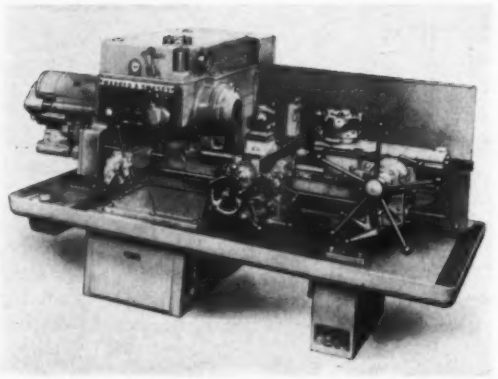


Fig. 2 1961 model turret lathe

easier to take metal off than put it back on."
Result — lost time in subsequent machining operations or in assembly, time that is never measured.

- Some of the tight tolerance jobs that used to be finished on this machine are now finished in a subsequent operation.
  Result — more cost.

- Only certain operators can get good work from the machine.
  Result — a waste of these men's particular skills in fighting machine deficiencies, a less flexible department.

- It takes longer to get tools and fixtures mounted and trued.
  Result — longer setup time.

- Cutters don't hold up as well as before.
  Result — more cutter expense, more time lost in tool changes.

- Dial adjustments are less reliable.
  Result — time lost "hunting for size" during setup and operation.

- Slides are worn unevenly.
  Result — more physical fatigue, less production.

- More cuts are required to hold tolerance than were once required.
  Result — longer production time.

- The operator works harder at holding tolerance and making good pieces.
  Result — he's more fatigued and less productive at the end of the day.

- Because of all of the above, operator morale becomes a problem.
  Result—production and quality both suffer.

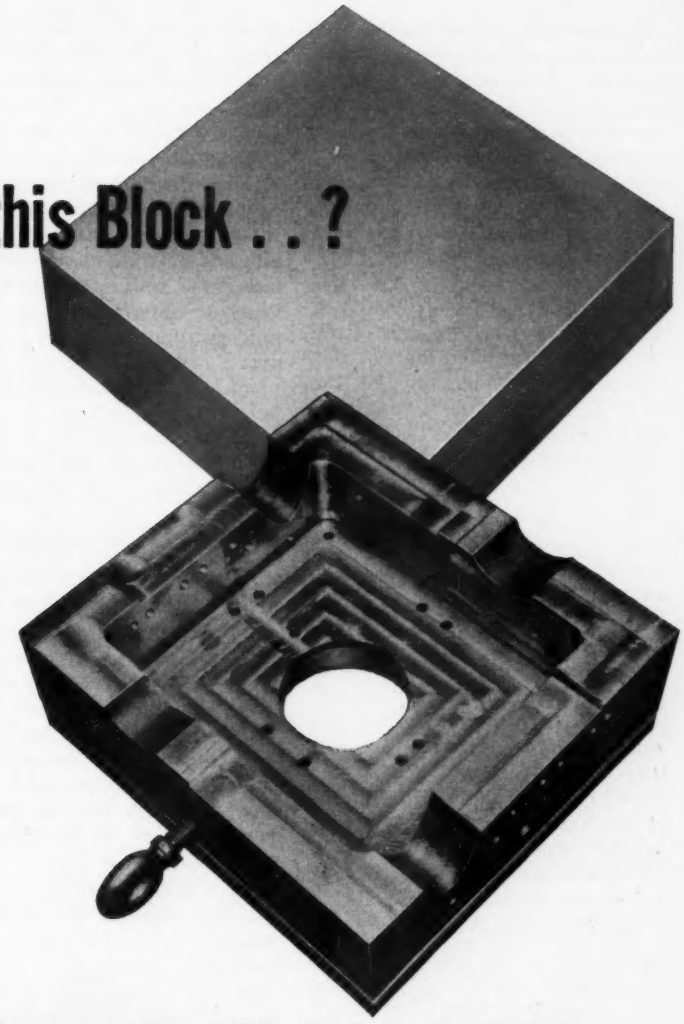
These and similar things are caused by every old machine in our shops. This is **deterioration,** but how do we measure it? No one of these things is tremendously important by itself. Some of them affect other departments. Others, perhaps, should show up as reduced production or as less ability to meet standards than have the newer machines. Unfortunately, in order to do his job, the good foreman hides as many of these deficiencies as possible! His main responsibility is to get work out of his department, not to make a case for replacing machines. Hence, the easiest and least demanding jobs go on the oldest machines. How, then, can we measure a lot of little things, many of which are hidden and don't ever come to light to be measured?

What we must do is find ways to **estimate** the total effect of deterioration, and to use in this estimate the same type of judgment that shop people have used for years in getting work out of their departments. This estimate will never be exact, but it's better to estimate as closely as possible than it is to delude ourselves that we can come anywhere near the answer by measuring individual items. I suggest two possible ways of making this estimate.

A Nonsensical Question Leads to A Sensible Answer

Fig. 1 shows a 1946 model No. 4 ram type turret lathe. Let's say this is the old machine you're thinking of replacing. Fig. 2 shows the 1961 model of the same machine. There are important inherent design advantages in the new machine — a 25% higher top spindle speed, 50% more horsepower available, an all-clutch shifting headstock so that all speed changes are instantaneous, and new optional features such as power collet chuck and rapid traverse. Because of these and other advantages, some of the work going across the new machine can be done as much as 30 to 40% faster than on the 1946 model when it was brand new, but this is not true of all work. There is no appreciable difference in setup time because of these new features, and many average day-to-day jobs do not require additional speed or horsepower. The actual advantage will be different for every shop, but for this discussion let's say the new design is 20% more productive than the old.

Why start with this Block . . ?



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Accept this as a fact for the time being. Now ask yourself what will appear to be a nonsensical question. Read this carefully — "For the most good pieces with the least problems in the coming year, if I had the choice, would I rather have the 1946 model brand new, or the 1961 model **after it has been used for 15 years?"** Fig. 1? or Fig. 3? This question sounds like it has been put backwards, but it's meant to be backwards. Here it is again. "Would I rather have the 'old' design machine brand new, or the 'new' design machine in the same worn condition as the 1946 model I'm thinking of replacing?"

Think about this for a moment. Although this is a choice we'll never have to make, there are very few of us who, faced with this situation, wouldn't want the 1946 model brand new. By so deciding, what we are really saying is that the deterioration of a machine of this type in 15 yrs more than offsets the 20% inherent design advantage of the new machine, and therefore we are saying that the deterioration of the old machine is at least 20%. Our judgment tells us that there is at least this much difference between the ability of a worn machine and a new one.

What if the new design is 25% better? Would you rather have the old design in a new machine or the new design in a machine that had been used 15 yrs? How about 30%?

The percentage at which your choice would be a standoff represents your own judgment of the deterioration of the old machine.

It doesn't matter at this point whether you actually plan to replace with another turret lathe or some other type of machine. You're not measuring the new machine, you're only arriving at an expression of how far downhill the old one has gone. Don't confuse the issue, either, with "which machine is worth more," or with what might happen to the value of either in future years. Say to yourself merely, "In order to get the most good pieces in the year ahead, I can have either this old model new or an improved design machine in the same physical condition as the old one now is. At what percentage of improvement will the two conditions balance?" Use as your criterion — and this is important — the work the **new machine** will be doing and not the work that has been done on the old machine.

Your answer on how far the old machine has deteriorated depends on many things. How many shifts has it run? How hard has it been abused? How tight are the tolerances on your work? For some types of equipment in some shops deterioration can be at least 50% over a 15-yr span. For other equipment and circumstances it may not be over 10 or 15%.

The important thing is that it is far more than we have been measuring by conventional means.

Downgrading Can Be Estimated

A different way to try to estimate the amount of deterioration is to estimate the effects of downgrading. Let's say that the old turret lathe is one of eight machines in a department. When it is replaced, the new machine does not take the place of the eighth machine. It goes to the head of the line, and each of the remaining seven machines is downgraded one notch as shown in Fig. 4.

Work that used to be on machine #8, now goes on #7; work from machine #5 to #4; and in each of these successive steps up the ladder some little saving is made. This doesn't happen in perfect order because the machines are not always equipped the same. But every time a new machine goes in at the top, individual jobs tend to be put on machines a little newer and a little better able to handle them.

Since it's impossible to measure the cumulative effect of machine downgrading by measuring each happening, the only way to measure it is to try to estimate the sum of all the effects by saying that the whole is equal to the sum of all the parts. To do this, imagine what would happen if you put the most difficult jobs and conditions on old machine #8. What would happen to production on those jobs? If your #1 machine is 100% productive on this work, how productive would the old machine be — 60%? 70%? The sum of all the little savings by downgrading is this same figure.

If the machine you're thinking of replacing is the only one you have of its kind, you have a different problem. Many of the effects of deterioration will not be hidden by downgrading. Since the machine is the only one available, you have to schedule both the toughest and the easiest jobs over it, and its deficiencies will be showing up on the tough jobs. Don't overlook the fact, however, that this machine has been partially downgraded by switching to other methods. You've lightened its load by going to prior or sub-

Fig. 3 A look into the future. 1961 model turret lathe . . . used!

Here are the step-by-step calculations you can use to add the effect of deterioration to the obsolescence factor demonstrated in Chapter II.

1) Estimate the deterioration of the old machine(s) by stating its present ability as a percent of its ability when it was new.

_____%

2) How many "old" machine hours have been replaced by the new machine's better design? (This has been previously calculated in Chapter II.)

_____**hours**

3) Divide (2) by (1) to get total "old" hours being replaced, including deterioration.

_____**hours**

4) Subtract (2) from (3) to get annual additional hours caused by deterioration.

_____**hours**

Example:

For old machines whose ability is now 75%, and where 5000 hrs are being replaced by the new machine's better design.

1) 75%

2) 5000 hrs

3) 5000 ÷ .75 equals 6667 hrs

4) 6667 less 5000 equals 1667 hrs saving from deterioration

sequent operations in some cases. When you estimate the deterioration on this machine, use as your criterion the jobs you would be doing with it if it were new, and not just the jobs you're now doing.

An Inexact Estimate Is Better Than None

Admittedly, in either of these methods, I'm talking about a pure estimate. What I've tried to do by this line of reasoning is to express, as closely as possible, the judgments that shopmen have been using for many years in retiring the older machines in their shop.

Until these judgments — as inexact as they might be — find their way into the replacement calculation, the calculation cannot be right. We would undoubtedly find the estimates wrong by many percentage points if we were able to measure accurately that which we are estimating, but if we give them **no** value because they can't be measured we're in worse shape.

Horrified financial management may say at this point, "But this gives the production people carte blanche to write their own ticket on replacement!" Who better should write the ticket? This estimate serves primarily to help keep replacement opportunities in their proper sequence, and the shop manager will have, for the first time, the chance to include his judgment in the calculation.

If you wish, set up for different types of machines "standards" of deterioration that are mutually agreeable to everybody involved. Any calculation would require explanation only if the estimate of deterioration fell beyond prescribed limits. The important point is that you agree there are values here that have not previously been measured.

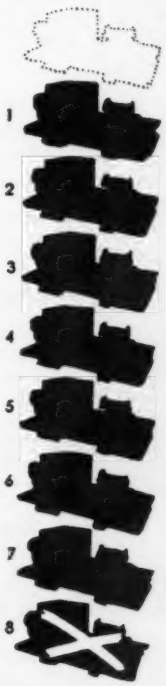

Fig. 4 The new one goes to the head of the line.

The "Hourly Saving" Calculation Is Easy

Once the estimate of deterioration percentage has been made, translating it into "hours saved" by replacement becomes an easy matter. To keep the arithmetic straight, deterioration should be estimated after obsolescence is measured (Chapter II). From the obsolescence calculation we have a figure of the savings from the improved design of the new machine. We now want to find the additional hours spent somewhere in our shop because the old machines have deteriorated.

Let's carry on with the same example begun in Chapter II. In that example there was an "obsolescence" saving of 1000 hrs because the improved design of the new machine enabled 5000 hrs worth of work to be done in 4000 hrs. Remembering from Chapter II, as well, that "percentages are tricky things," you might now want to use the accompanying exact calculations.

This saving should be added to obsolescence saving (1000 hrs in Chapter II example) to get the total hourly saving (2667 hrs) from the proposed replacement. The "new machine hours," 4000, could be subtracted from #3 here to get the same answer.

Should scrap, maintenance or downtime be figured separately and added to the above savings? Only if they have **not** been included in the foregoing judgments, and only if they are significant. It's obvious by now that we're dealing with inexact figures, and a few dollars either way won't make any difference.

We do, however, have a figure that more nearly represents the true picture than the "exact" calculations we've been trying to make. This is the key to the whole calculation.

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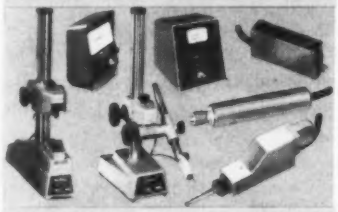

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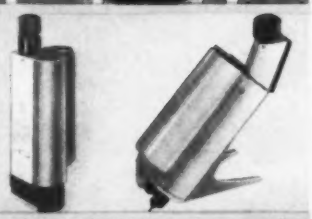

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★ **COMPARATORS**
Electronic
Trans•Chek Height Gage
Trans•Chek Comparator
Micro•Chek Comparator
Micro-Plane
Mechanical
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★ **BLACK GRANITE PRODUCTS**
Surface Plates • Angle Plates
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Magnetic Chuck Platforms
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★ **OPTICAL GAGING**
Contour Measuring Projectors
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Stereo Microscopes
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★ **THREAD—CYLINDRICAL GAGING**
Adjustable Thread Rings
Truncated Setting Plugs
Thread Work Plugs
Cylindrical Plugs

★ **SHOP GAGING**
Micrometers
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Thickness Gages • Rules
Squares • Levels
Dial Indicators • Sinometer
Bore Gages

GB-40

This is a typical DoALL Store

The DoALL Company, Des Plaines, Illinois

Call Your DoALL Sales-Service Store

MACHINE TOOLS | CUTTING TOOLS | MEASURING INSTRUMENTS | SHOP SUPPLIES

CIRCLE INFORM-A-GRAM KEY NO. 64

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19250 Plymouth Road, Detroit, Michigan, VErmont 5-6000. Tools and Dies, Special Machinery, Sheet Metal Stampings and Assemblies.

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CLEVELAND UNIVERSAL JIG COMPANY
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DESIGNERS AND BUILDERS
Jigs and Fixtures Special Machines
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Made to Specifications
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THE INDUSTRIAL MACHINE CO.
1436 East 47th St., Cleveland, Ohio. Founded in 1908. Builders of Special Machinery. General Machine Work.

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5601 Tillman Avenue, Cleveland, Ohio. WOodbine 1-2440 & 1-2441. Manufacturers of Special Machinery, Tools, Dies, Jigs, Fixtures, Swiss Jig Boring.

NOBLE & STANTON, INC.
998 Broadway, Bedford, Ohio, BEdford 2-2800. Tooling, Short Run Production and Machined Parts for Automation.

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SQUARE ROOT TABLES
1 TO 10,000
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RESULTS GUARANTEED
BBF Precision Grinding (BBFPG) resharpens dull machine/hand files to New File Efficiency, without affecting temper, cut or hardness. We solicit your interest.
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When you specify SEIBERT

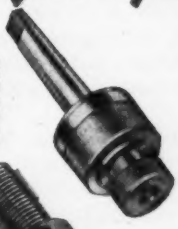
HOLDING TOOLS you get

- ADVANCED DESIGN
- PRECISE WORKMANSHIP
- FINE MATERIALS
- QUICK SERVICE

These are the money-saving advantages of Seibert Production Holding Tools. And because of them, an excellent reputation has been built for these tools in many mass-production plants throughout the country — automobile, truck, tractor, agricultural implement, earth-moving equipment, etc.

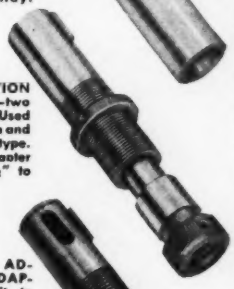
In addition these advantages have influenced prominent machine tool builders to specify Seibert Holding Tools when tooling up machines being furnished to mass-production plants. They know from experience that Seibert Tools will meet the most exacting requirements of their customers.

You can investigate the advantages of Seibert Tools by telling us your requirements. Complete data will be sent at no obligation to you.



FLOATING HOLDERS — provide full float, quick tool changes, a variety of shank types and sizes, including an adjustable adapter shank.

SPINDLE EXTENSIONS — provide individual spindle adjustment and extend or alter existing multiple setups without extensive retooling outlay.

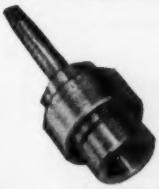


DOUBLE-ACTION TAP DRIVERS — two tools in one. Used both as tension and compression type. Made in 6 adapter sizes from ½" to 1⅜".

SHUR-LOCK ADJUSTABLE ADAPTERS — built to GMC, Ford, Chrysler and ASA standards. Concentricity .002" TIR 6" from nose. Sturdy, dependable.

DRIVERS — hardened, ground, precision built, concentric within .002". Made to automotive, ASA standards. All types and sizes.

RECESSING TOOL HOLDERS — feature master holder, interchangeable adapters, and two cam-follower pins for accurate work.



MAGIC CHUCKS — feature quick-change, interchangeable collets and construction features for accuracy and convenience.

SEIBERT **SEIBERT & SONS, INC.** 1012 E. 24th STREET CHENOA, ILLINOIS

Quality MULTIPLE DRILL SPINDLES AND PRODUCTION TOOLS

CIRCLE INFORM-A-GRAM KEY NO. 651

Every TOOL ROOM NEEDS THIS BIG *Free* REID CATALOG

New big FREE 88 page catalog listing 2000 accessories and components needed in every tool room, such as malleable machine handles c.i. hand knobs, hand wheels, etc. All are top quality and low cost. Orders welcome for one or a thousand.

COMPRESSION SPRING ASSORTMENT

Available in many sizes ranging from 3/32" to 1-1/2" diameter. Made from music wire. All springs 10" long. Select the size required and cut to length wanted. Saves time and money.

Extension spring assortment, ranging in diameters from 1/8" to 1". All are 11" long. Low prices.

BALL HANDLES — THREADED

ROUND PLASTIC

OVA OVAL PLASTIC

MUSHROOM PLASTIC

Will give your product that "dressed-up" appearance. Made in a wide variety of diameters and thread sizes. Round and oval plastic supplied in red or black. Polished steel handles also supplied. Low prices and finest quality.

REID TOOL SUPPLY CO.
MUSKEGON HEIGHTS, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 652

Engineering Education

A student's-eye view of how to get into and through graduate school has just been published by the American Society for Engineering Education. Graduate study is becoming more important in engineering, and not every engineering student should take graduate study, but he should consider the possibility. "The Road to Graduate School" will give him the data to consider that possibility intelligently.

The new publication tells the engineering undergraduate about graduate study and the life of the graduate student. It was published by ASEE's Committee on the Development of Engineering Facilities.

Publication was supported by the Ford Foundation. The new booklet gives the undergraduate a clear, objective picture of what graduate study is like, what its goals are, and what it requires of the student.

The booklet is being distributed through engineering deans and individual chapters of Tau Beta Pi. It is available free to all undergraduate engineering students.

Illustrated, "The Road" presents 20 pages of the essential information for planning graduate study, including the reasons for taking graduate work, and the kinds of degrees available. The section telling "when and where to apply for what" is followed by a calendar for applications and inquiries that should help the student meet deadlines. There is even a section on married housing, jobs for the wife and similar problems that may be involved.

A section on financial support outlines advantages and disadvantages of types available, concluding that the qualified engineer should have no trouble getting financial assistance.

Inventory 'Clearing House' Established

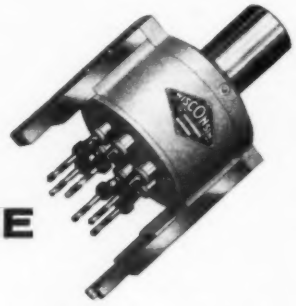
A new approach to the overstocked inventory problem has been tackled by Manufacturers' Exchange Corp., a new enterprise based in Holland, Mich.

It's a subscription service clearing house. Subscribing manufacturers furnish the Exchange listings of standard inventory items, in more than 140 categories, which they want to buy or sell. These are coordinated alphabetically in one major listing, and sent out to subscribers nine times a year by the Exchange. Each subscriber is given a code number, and contact between prospective buyers and sellers is made through the Exchange's central office.

It's an economical method of locating items in some other manufacturer's inventory, and a step toward purchasing them at attractive prices, since they may be in the "soon-to-be-disposed-of" category. However, no rebuilt or sub-standard items will be listed by the Exchange.

Manufacturers' Exchange Corp., Peoples National Bank Bldg., Holland, Mich., will furnish an informational brochure in response to a request on company letterhead.

CHOOSE WISCONSIN FOR TOP PERFORMANCE



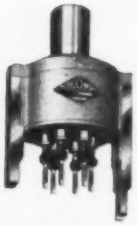
Wisconsin Rotating Heads — designed and built to fit all types of lathes and chucking machines.

Adjustable Multiple Spindle Drill Heads — double eccentric for irregular hole spacing.

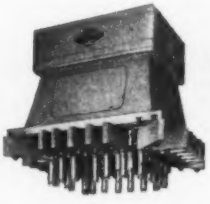
The highly efficient, low-cost performance of these modern rotating heads on automatic chucking machines and lathes has been proved in a variety of drilling and tapping operations.

The experienced counsel and technical assistance of the Wisconsin engineering staff is available to you on your drilling and tapping operations. Write today.

Fixed Spindle Drill Heads — engineered to your specifications.



Rotating Multiple Spindle Tapping Heads — for turret lathe or chucking machine.



Wisconsin Multiple Spindle U-Joint Heads — bracket type or with slip spindle fixed locating plate.

Convertible Type Drill Heads — engineered for high productivity.

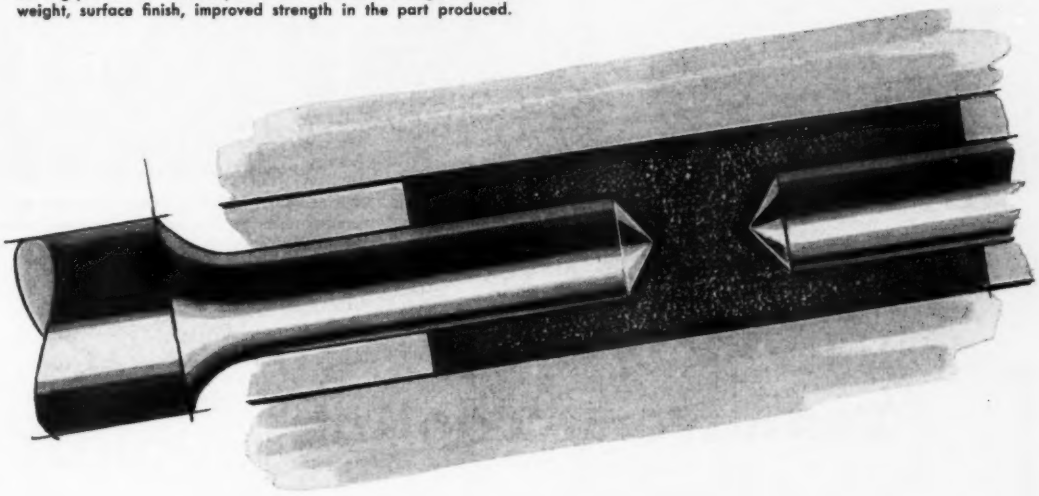
WISCONSIN DRILL HEAD CO.

4975 N. 124TH STREET • BUTLER, WISCONSIN

CIRCLE INFORM-A-GRAM KEY NO. 66

"MOVING METAL" with Carboloy® Cemented Carbides

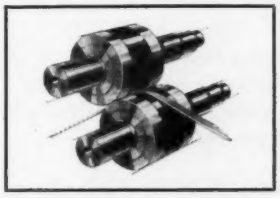
From solid slug to wrist pin — 2,000 an hour! Increased production is but one of the advantages when you use extruding and coining punches of Carboloy cemented carbides. You get uniform weight, surface finish, improved strength in the part produced.



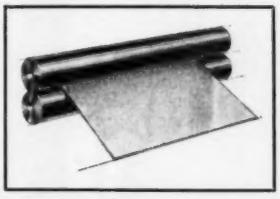
Reduce costs, save machining time with Carboloy® cemented carbides

How efficiently you "*move metal*" from one shape to another depends on the quality, accuracy and uniformity of the carbide you use. General Electric Carboloy carbides for coining and extruding punches, wire-flattening and sheet metal rolls are designed to do the job better, in less time, at lower cost, with less metal waste.

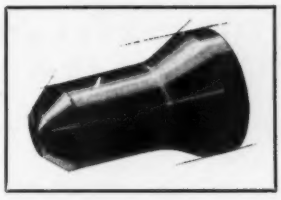
Continuing research by General Electric's metallurgists and technicians results in carbides of highest quality and uniformity — dependability for the job at hand. Call your Carboloy Die Distributor or Die Maker to help you "*move metal*" at lower cost. Or write: *Metallurgical Products Department of General Electric Company, 11111 E. 8 Mile Road, Detroit 32, Michigan.*



When it comes to wire flattening, rolls of Carboloy cemented carbide outlast steel rolls many times. Smooth, wave-free roll surfaces produce rolled-flat wire products of exceptional quality and finish; consistent uniformity.



You get uniform, more even sheet when you use rolls of Carboloy cemented carbides. Roll structure is uniform throughout; excellent for working stainless steel. Carboloy rolls last longer and do jobs not possible with steel rolls.



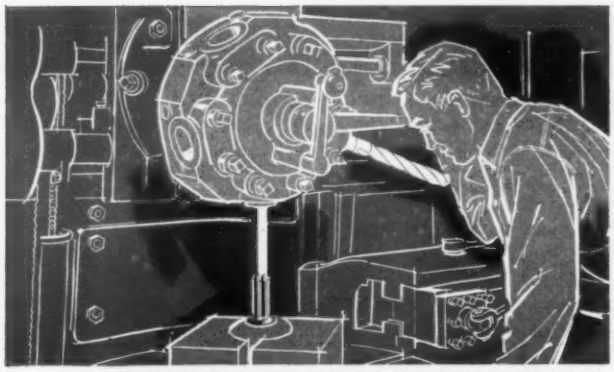
Cold extrusion punches made of G-E carbides find a wide variety of applications. For example, in the production of bearings, a solid carbide punch forms a race and cup from one steel slug—minimum waste; saves machining.

CARBOLOY®
CEMENTED CARBIDES

METALLURGICAL PRODUCTS DEPARTMENT
GENERAL ELECTRIC

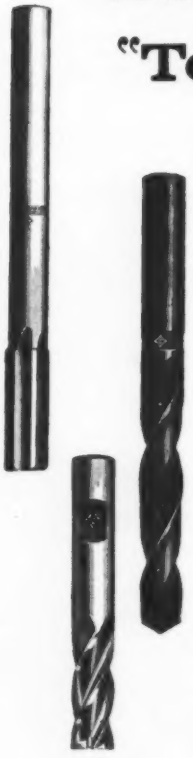
CARBOLOY® CEMENTED CARBIDES • MAN-MADE DIAMOND • MAGNETIC MATERIALS • THERMISTORS • THYRITE® • VACUUM-MELTED ALLOYS

CIRCLE INFORM-A-GRAM KEY NO. 67



As a result of cooperation of his Industrial Supply Distributor and a CLEVELAND Service Representative, this customer was able to ream 1,800 holes per grind in a 1040 steel projectile part, without sacrifice of hole size or finish. A typical example of "Teamwork Tooling"!

How to get cost reduction through "Teamwork Tooling"

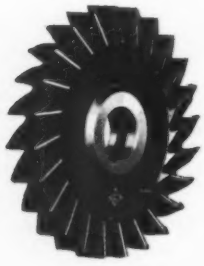


When you tackle the problem of cost reduction, you will find the solution is not *cost per tool*, but rather *cost per hole*.

And, if you apply Value Analysis to the subject of cost per hole, you always arrive at the same answer: Only with *quality* tools can you get faster production, less down-time and fewer rejects.

When you buy CLEVELAND Tools you get the very best manufacturing experience and know-how . . . *plus* the added benefits of "Teamwork Tooling", which means combining the skills of many people to help you reduce costs.

CLEVELAND Quality Tools can be obtained from the stocks of your local Industrial Supply Distributor, who has the assistance of our trained Service Representatives to recommend savings through proper tooling for *your* job conditions.



THE CLEVELAND TWIST DRILL CO.
Cleveland 1, Ohio

QUALITY CUTTING TOOLS • BEST SERVICE THROUGH YOUR LOCAL DISTRIBUTOR

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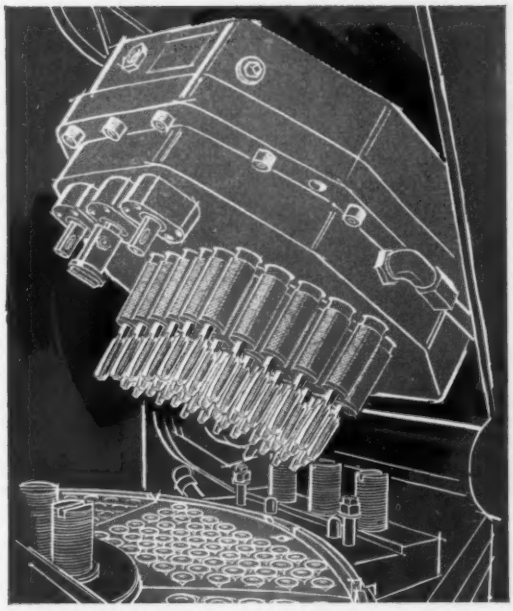
CIRCLE INFORM-A-GRAM KEY NO. 68

To Help You Cut Your Tapping Costs

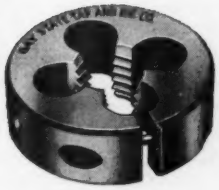


BAY STATE Taps have the strength and stamina to reduce costly down-time on this high speed set-up, where 25,000 holes are threaded per hour. The taps have built-in QUALITY . . . your assurance of cost reduction on all jobs, whether large or small.

The most economical tapping operations can be performed only with *highest quality* taps.

You can reduce your costs with BAY STATE *Quality* Taps. These tools are designed, engineered and manufactured for precision performance . . . to give you long, dependable service which is your assurance of maximum production with a minimum of costly down-time.

BAY STATE *Quality* Taps and Dies are carried in stock for prompt delivery by your local Industrial Supply Distributor, who maintains balanced inventories for you at lowest cost. Moreover, the steady flow of orders from hundreds of distributors enables us to produce the tools in large, economical quantities—with resultant advantages to you.



BAY STATE TAP AND DIE CO.
Mansfield, Mass.

Subsidiary of The Cleveland Twist Drill Co.

QUALITY CUTTING TOOLS • BEST SERVICE THROUGH YOUR LOCAL DISTRIBUTOR

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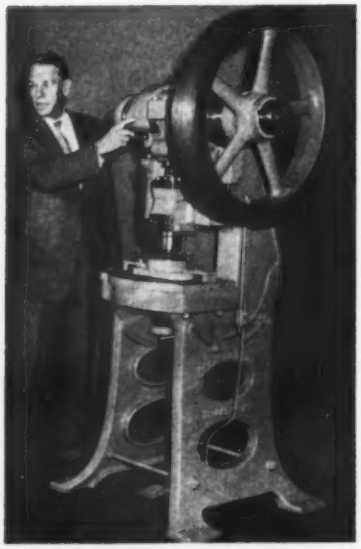
CIRCLE INFORM-A-GRAM KEY NO. 69

Early Power Press



A 73-yr old V & O OBI press is among the first items of equipment selected and obtained by the Smithsonian Institute for its Industrial Development of the United States exhibit scheduled to open in 1962. It was provided by the Emhart Mfg. Co.

The 22-ton capacity press was the third unit built by the original Vieillard & Osswald Co. It introduced changes that had an important influence on the design of power presses. Among these changes were a long slide, impact thrust to the frame rather than the journal cap, and containment of the pitman ball. The press had seen almost continuous duty from 1888 until 1954 when it was reconditioned and given an honored place in Emhart Mfg. Co.'s Hudson Div. showroom in Hudson, N.Y.

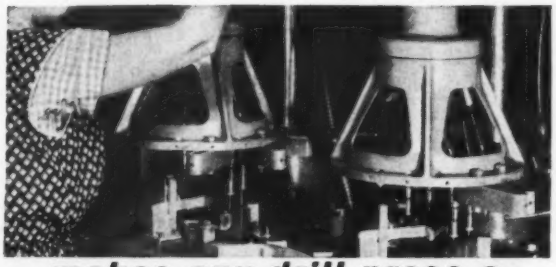
SITUATION WANTED

Executive for top or middle management. Experience in areas of production, sales, marketing and distribution of hard lines parts, products and equipment. Conversant with a variety of production methods and techniques; design essentials; sales promotional art, copy, layout and media. Able to plan, organize, execute and evaluate progress in company programs and campaigns. Salary range $18,000 to $20,000. Excellent references. Will relocate. Write Box 4, Tooling & Production Magazine, 1975 Lee Rd., Cleveland 18, Ohio.

Joining Thin Sections

Assembly of a thin-wall expansion bellows into a diesel engine exhaust was accomplished through brazing with Nicrobraz, made by Wall Colmonoy Corp., Detroit, Mich.

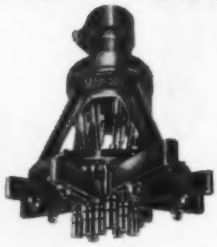
Pipe, flanges and bellows for the exhaust tube are fabricated of Type 302 austenitic stainless steel. The 0.010 wall thickness in the bellows couldn't be welded because of possible burn-through. In production, the two pipe sections were slipped into the sleeve ends of the bellow. Brazing alloy was then applied and the part placed into a pure hydrogen atmosphere furnace at 1900°F. For more, circle Inform-A-Gram No. D3.



makes any drill press a

HIGH PRODUCTION TOOL

in minutes!



With a MULTI-DRILL, you can go from hole-at-a-time drilling to real production in a matter of minutes! That's all the time it takes to mount any one of the many standard MULTI-DRILL adjustable multiple spindle drill press attachments on any drill press and put you into time and money-saving multiple drilling. Every MULTI-DRILL is quickly adjustable to drill a variety of hole patterns. Every MULTI-DRILL is designed for high production work. To learn how you can profit with a MULTI-DRILL, ask your nearby Commander Distributor to show and demonstrate the unit that meets your job requirements.

Write for the Production Tool Catalog. 109

Commander MFG. CO.

4228 WEST KINZIE • CHICAGO 24, ILLINOIS

See Us At Booth 3209, ASTME SHOW, New York Coliseum

CIRCLE INFORM-A-GRAM KEY NO. 701

Drill Press Tooling
Adjustable short-run drill jig
Self-centering air vise
Combination tapping/deburring tool

Lathe Tooling
Ball-turning tool for concave and convex radii
Quick-change tool holders for turret work on standard lathes

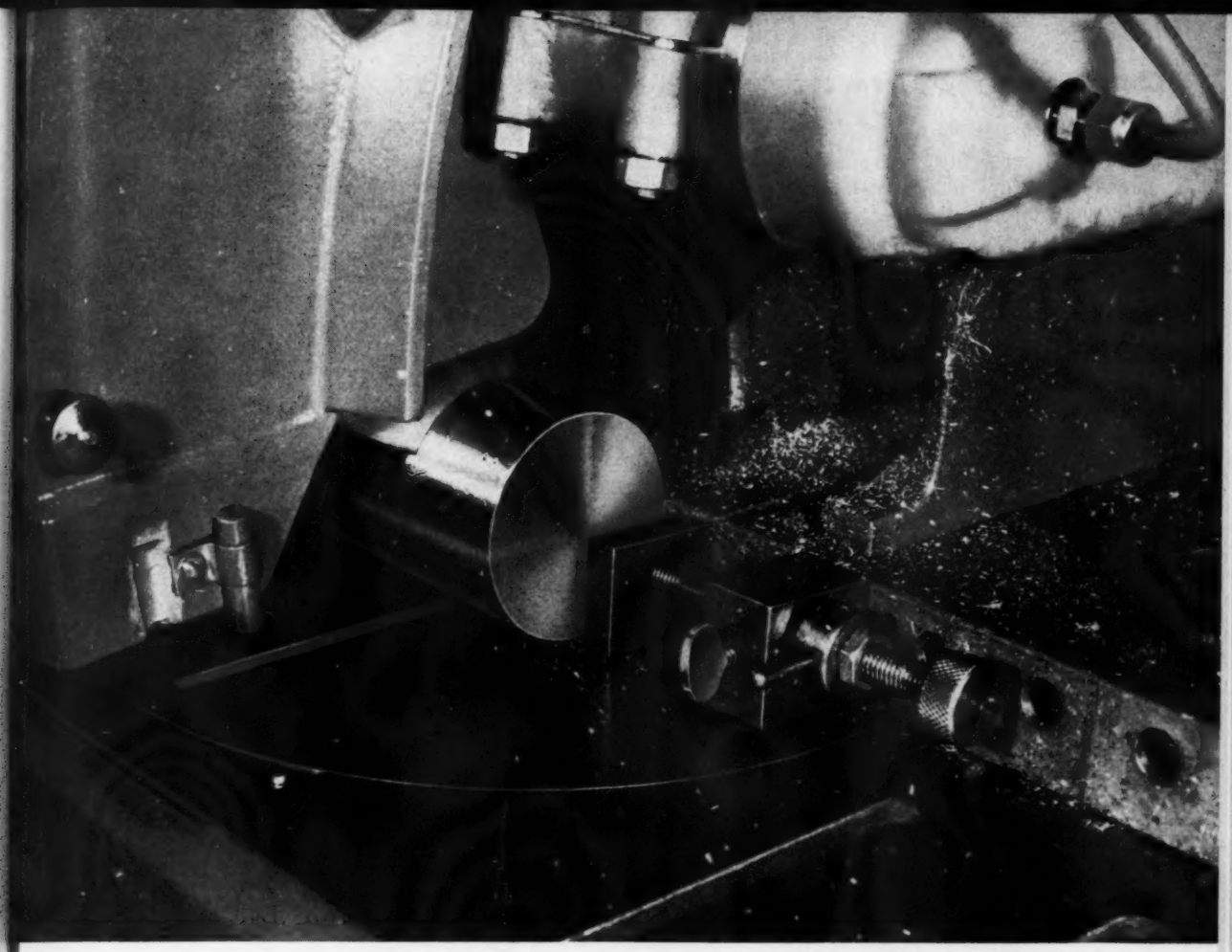
Surface Grinder Tooling
Jaws for holding non-magnetic material on magnetic chucks

Milling Machine Tooling
Vise with automatically contouring jaws for any odd shape work

Inspection Tools
Thread Triangles for simplified measuring of pitch diameter

MONTGOMERY & CO. • 405 Morris Ave., Springfield, N.J., DRexel 6-4767

CIRCLE INFORM-A-GRAM KEY NO. 702



You can make $356.85 do more—
get DELTA'S NEW 12" Cut-Off Machine

Put the new Delta 12" Cut-Off Machine through its paces. Take a sample work piece to your Delta Distributor—cut it—judge this tool on results!

FREE BROCHURE: Complete specifications of all models of the Delta 12" Cut-Off Machine. Write: Rockwell Manufacturing Company, Delta Power Tool Division, 622D N. Lexington Ave., Pittsburgh 8, Pa.

Here's a tool that will cut a square inch of steel in about four seconds—and do it all day long! At a low $356.85*, it's a value you'll want to see for yourself. With a choice of 3 hp and 5 hp motors, you get the power to handle bar and tube stock up to 3¼" in diameter, 3 x 3" angles, 4" channels, wood and plastic up to 2 x 8". You can equip for dry or wet abrasive cutting of a wide variety of materials at speeds above 12,000 sfpm.

You'll like these three exclusive features Delta offers: Retractable Size Gage that quickly and accurately gages stock from 0" to 14" and prevents binding of cutting tool in stock; *Hollow Arbor Mist Coolant* that makes mirror smooth saw blade cuts on non-ferrous stock faster, easier; *Replaceable Arbor* that practically eliminates downtime because special cartridge assembly can be replaced in minutes. Your Delta Industrial Distributor will tell you more—he's in the Yellow Pages under TOOLS or MACHINERY.

**No. 20-111 complete machine less electricals.*

DELTA INDUSTRIAL TOOLS

another fine product by

ROCKWELL

CIRCLE INFORM-A-GRAM KEY NO. 71

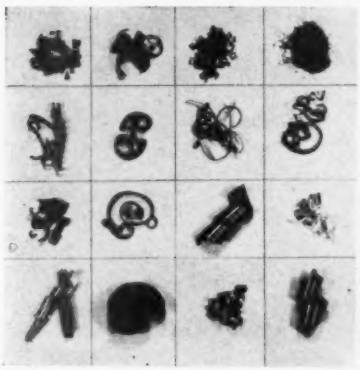
Chips From the Cover...

You will probably recognize many of the chips shown on our cover as being similar to those made in your own plant. They are an essential by-product of production by machining.

Chips are an interesting subject for many men in metalworking. Although we plan and re-plan machining jobs so as to reduce the amount of metal to be removed, chips are still a popular shirt-sleeve indicator of metal removal rates.

Shown on the cover are some interesting examples of chips produced by cemented carbide and cemented oxide cutting tools on late-model machine tools.

An enterprising service engineer of Metallurgical Products Dept., General Electric Company,



is a collector of chips produced by machine tools equipped with his company's cemented carbide and cemented oxide cutting tool materials. Shown on the cover are some of the chips gathered by Ben Storrs as evidence of the ability of Carboloy products to remove metal ... quickly and cheaply.

We will be glad to send you a color reproduction of this month's cover, with a brief identification of each chip sample and the speeds, feeds, etc. that were used. For your copy, circle No. D-4 on the Inform-A-Gram card.

Available while they last.

NEW! Logan 14" LATHES BEST DOLLAR VALUE IN THE LATHE FIELD

These new Logan 14" swing lathes are **DEPENDABLE.** Their capacity permits a broad range of machining operations. They have a 14⅛" swing over bed, a swing over saddle cross slide of 9", and a center distance of 28". Logan lathes are **ACCURATE.** The ball bearing spindle has a 1⅜" hole and a draw in collet capacity of 1 1/16". The variable speed drive (40 to 1400 RPM) adjusts while running —no need to stop and shift belts! Also, the two V-ways and flat ways are precision ground. Logan 14" lathes are **RUGGED.** The 10" wide and 56" long lathe beds are braced by oversize ribs to withstand torsional stresses. The Logan 14" lathe is your best dollar value. No other lathe in this price category offers you this same big work capacity with variable speed drive.

Model 6510
$1,775.00
F.O.B. Factory

Write for complete specifications.

Logan
LOGAN ENGINEERING CO., [illegible]
4901 W. Lawrence Ave., Chicago 30, Ill.

CIRCLE INFORM-A-GRAM KEY NO. 72

New Nuclear Gages

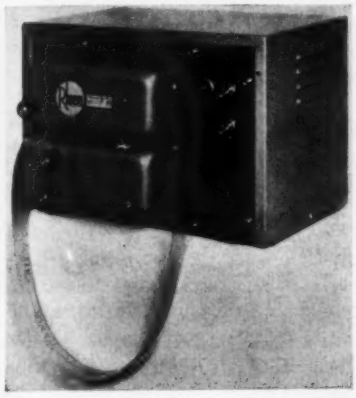
A new line of nuclear gages for non-contacting thickness-density measurement and process control has been announced by Radionics Incorporated of Norristown, Pa.

The basic gaging unit, called a Micro-Meter, differs from beta gages now on the market in that it utilizes a highly specialized technique of scintillation detection developed by Radionics. The detector permits the use of either beta or gamma radiation, extending the range of application from the thinnest tissue paper to a foot of steel or more.

Sensitivities depend on the source selected. Gamma sources, with high penetrating power, allow measurements to within ±0.001 of steel equivalent, while beta sources allow thin sheets and foils to be measured within a few micro-inches. The high speed of response — down to 10 milliseconds — permits extremely high speed inspection.

Automatic Control of Bore Diameter

Machine tool automation has become reality to many more companies thanks to a new numerical positioning control system made by the Electronics Div. of Rheem Mfg. Co., 5200 W. 104th St., Los Angeles 45, Calif.



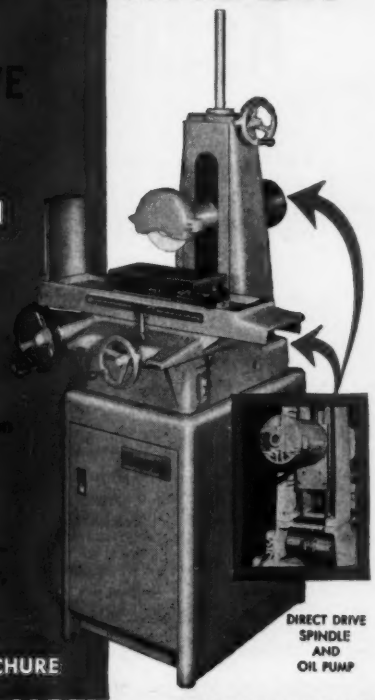
The system is the first to achieve automatic control of bore diameter while the spindle rotates. It distributes tape information electronically and eliminates less reliable stepping and crossbar switches. Of modular construction by axes, it allows a choice of resolutions, high positioning speeds, feed rate controls, larger travel distances, decimal display of tape information, automatic, semi-automatic, and manual modes, as well as unlimited auxiliary functions. Write Rheem Mfg. Co., or circle Inform-A-Gram No. D5.

Big Wind

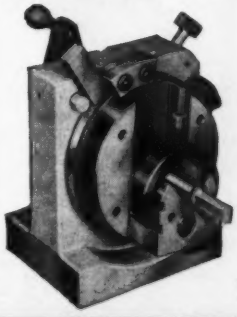
Conditions similar to those encountered by a missile when it re-enters Earth's atmosphere are produced in a wind tunnel built recently by McDonnell Aircraft Corp., St. Louis. It develops "speeds" from 10 to 27 Mach, or up to 20,000 mph, 14,000°F temperatures, and pressures as great as 100,000 psi.

McDonnell designers call their wind tunnel the "hot shot." Its key structural components are made of a high strength steel made by Vanadium-Alloys Steel Co., Latrobe, Pa.

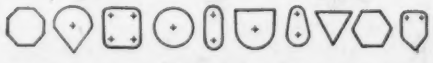
Harig 612
SURFACE GRINDER
with
NEW...EXCLUSIVE
AUTOMATIC FORCED LUBRICATION
• Continuous flow, recirculating system
• Washes away damaging grinding dust
• Triples life of ways
• Preserves original accuracy
• Promotes easy table operation
• Reduces maintenance — all complete machine
...and many other features included as standard equipment, all at a surprisingly low price!
WRITE FOR HARIG 612 BROCHURE



THE FASTEST WAY TO GRIND PERFORATORS . . . INCREASE ACCURACY
HARIG GRIND-ALL FIXTURE

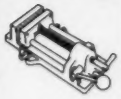


Easily grinds irregular shaped perforators concentric with shank within ± .0001 accuracy. Also can be used for milling, boring, and inspection. New features include V-block adjusting screw and sine arrangement to obtain any desired angle. Attachment available to convert Grind-all into precision Radius Dresser.



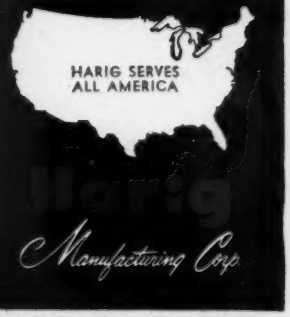
WRITE FOR NEW GRIND-ALL BROCHURE

OTHER PRODUCTS BY HARIG MACHINE TOOL DIVISION


VISES

RELIEF-GRINDING FIXTURE

AIR-FLO FIXTURE



WRITE FOR BROCHURES

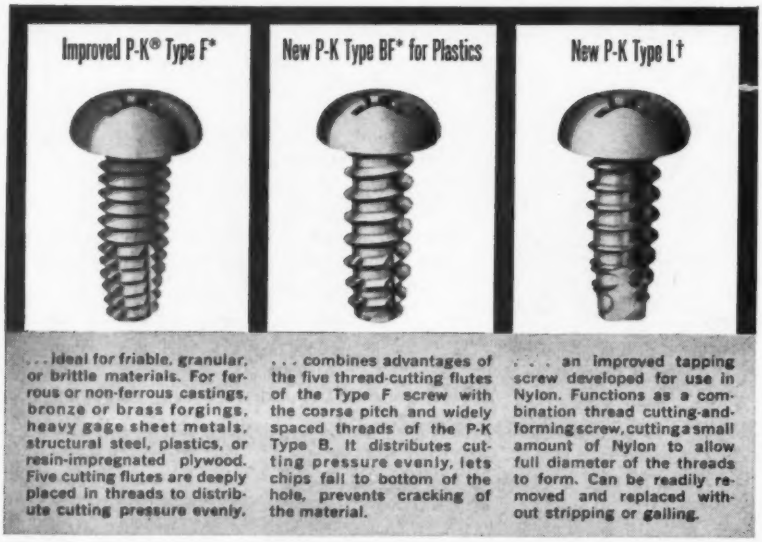
Harig Manufacturing Corp.

5761 W. HOWARD STREET • CHICAGO 48, ILLINOIS
VISIT HARIG BOOTH 1514 (A.S.T.E. SHOW)
CIRCLE INFORM-A-GRAM KEY NO. 73

This Formula Will Lower Your Assembly Costs!

$$\text{Function Factor} = \frac{(\text{Strip Torque})^2}{\text{Driving Torque}}$$

Used as a measure of evaluating thread-cutting screws, it proves that P-K Screws average 108% better working qualities than competitive types tested. **Here's what this means to you:** (1) stronger assemblies because of high resistance to thread failure, (2) less wear on driving tool, less operator fatigue through easier driving of screw, (3) reduced salvage and costly downtime problems due to greater in-place efficiency. Whatever the material, whatever the requirement, there's a P-K Thread-Cutting Screw just right for you! Write for your copy of Bulletin 2d containing full details on how the Function Factor Formula lowers assembly costs.


Improved P-K® Type F*
New P-K Type BF* for Plastics
New P-K Type L†
. . . ideal for friable, granular, or brittle materials. For ferrous or non-ferrous castings, bronze or brass forgings, heavy gage sheet metals, structural steel, plastics, or resin-impregnated plywood. Five cutting flutes are deeply placed in threads to distribute cutting pressure evenly.
. . . combines advantages of the five thread-cutting flutes of the Type F screw with the coarse pitch and widely spaced threads of the P-K Type B. It distributes cutting pressure evenly, lets chips fall to bottom of the hole, prevents cracking of the material.
. . . an improved tapping screw developed for use in Nylon. Functions as a combination thread cutting-and-forming screw, cutting a small amount of Nylon to allow full diameter of the threads to form. Can be readily removed and replaced without stripping or galling.

PARKER-KALON®

THREAD-CUTTING SCREWS AND SEMS

PARKER-KALON a division of General American Transportation Corporation, Clifton, New Jersey • Offices and Warehouses in Chicago and Los Angeles.

*Patent Pending

†U.S. Patent 2,350,346

CIRCLE INFORM-A-GRAM KEY NO. 74

Grinding Wheel Industry Sees Future Growth

At the recent 4th Annual Mid-Winter Conference of the Grinding Wheel Institute, it was disclosed that there are several new developments and trends in grinding practice that indicate wider use of grinding wheels as efficient production tools.

Among these are 1) the trend to higher operating speeds in both precision and automatic billet grinding operations under properly controlled conditions, 2) the ability of modern grinding wheels and grinding machines to produce ever closer tolerances and finishes — now being measured in millionths of an inch, 3) the capabilities of the grinding wheel to work many materials that cannot be worked by other means, including the new exotic or space age materials, 4) the improvements in crush dressing techniques in crush dress grinding on certain classes of precision and form grinding and, 5) the development of closer standards of grinding action to improve the use of grinding wheels on automated production lines under numerical control or taped programs.

'Copter-Carried Defense Control

The nation's first helicopter-borne electronic air defense control system has been delivered to the U.S. Marine Corps. It is the first of four "Airtrac" systems developed and manufactured by Hughes Aircraft Co.'s ground systems group. The system will coordinate split-second firing of Hawk and Terrier guided missile batteries to insure nearly instant destruction of hostile supersonic aircraft.

Airtrac is installed and transported in helihuts, 3500 lb plastic and aluminum "boxes" approximately the size of the rear section of a 2½ ton truck carried underneath a Marine 'copter.

Dial-In Setups

An operator can now "dial in" coordinate dimensions of a workpiece directly from a print to a Jigmill through a new measuring system that simplifies jig boring.

Mathematics in setup have been reduced with the Diatrol system made by DeVlieg Machine Co., Royal Oak, Mich. Through two direct-reading dials, dimensions for horizontal table and spindle movement can be preselected.

Either positive or negative dimensions within the range of the system can be dialed in, and a push of a button automatically positions the table and spindle head in seconds. While the machine works, the operator can preset for succeeding operations.

The system can be calibrated to the ultimate in accuracy and it's said to be ideal for toolroom, experimental work, and jigless boring of custom or small lot jobs. Circle Inform-A-Gram No. D6.

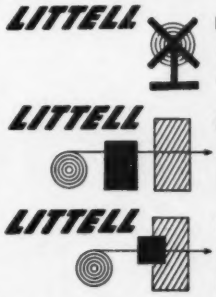
PROTECT YOUR FUTURE — BUY U. S. SAVINGS BONDS TODAY!

AUTOMATIC ELECTRIC Relays

Get These Precision Springs

From LITTELL-Fed Presses

Here is precision stamping. These springs actuate the sensitive Automatic Electric Relays that serve as "brain cells" in various computers—as "nerve centers" in complex teletypewriter switching systems. Automatic Electric makes sure of sustained precision results by stamping these vital springs on electronically controlled punch presses served by Littell equipment.



LITTELL **REELS AND COIL CRADLES** supply the stock in a smooth, even flow.

LITTELL **STRAIGHTENERS** remove coil curvature, send flat stock into the press.

LITTELL **ROLL FEEDS** pull the straightened stock into the die area in perfect timing with the press stroke.

The entire operation is automated, automatic and safe. Safety devices automatically stop the press and protect the die when stock has been consumed or if any malfunction in parts ejection, or stock location occurs.

Full details on the modern Littell Reels, Straighteners and Feeds used at Automatic Electric for high speed, quality-controlled precision stamping are available on request. Write for catalogs today.

F. J. LITTELL MACHINE CO.

COILY SUGGESTS *these catalogs for you:*

For REELS CATALOGS D-1, D-10, D-20
For STRAIGHTENERS C-SERIES CATALOGS
For ROLL FEEDS CATALOGS A-1, A-10, A-15

4197 N. RAVENSWOOD AVENUE, CHICAGO 13, ILLINOIS
CIRCLE INFORM-A-GRAM KEY NO. 75

Producto's New DIE ASSEMBLER

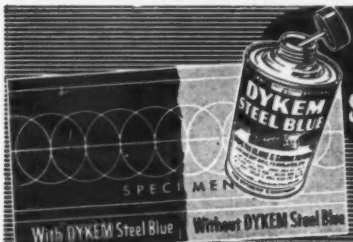
Hydraulically actuated lift table; upper platen revolves 360°, develops 3000-lb. closing force and 1500-lb. separating force. Battery-driven; mobile, no trailing wires. Invaluable in the manufacture and repair of dies. Write today:

TOOLROOM EQUIPMENT DIVISION

THE PRODUCTO MACHINE COMPANY

945 Housatonic Ave., Bridgeport, Conn.

CIRCLE INFORM-A-GRAM KEY NO. 761



DYKEM STEEL BLUE

Stops Losses making Dies and Templates

Popular package 8-oz. can fitted with Bakelite cap holding soft-hair brush for applying right at bench. metal surface ready for layout in a few minutes. The dark blue background makes the scribed lines show up in sharp relief, prevents metal glare. Increases efficiency and accuracy.

Write for sample on company letterhead

THE DYKEM COMPANY

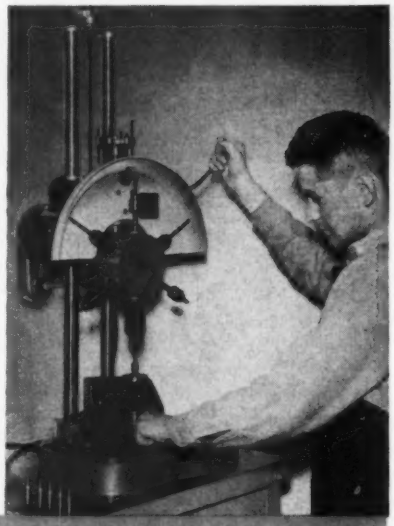
2303L North 11th St. • St. Louis 6, Mo.

CIRCLE INFORM-A-GRAM KEY NO. 762

$595 BURGMASTER Turret Drill Replaces $8000 Chucker - Increases Production 400%

The Pelto Machine Co., Los Angeles, California, use a Burgmaster 6-Spindle Bench Model Turret Drill to perform five operations on Chrome-Nickel tool steel parts formerly machined on a single spindle Chucker. The change has stepped up production from 24 to 120 pieces per hour —an increase of 400%—and the $595 Turret Drill plus a $400 Standard Fixture replaces a machine representing an $8,000 investment.

These are typical savings possible with the Burgmaster Bench Model Turret Drill for such operations as drilling, reaming, tapping, boring, counterboring, etc. This machine is much faster because each spindle is quickly power indexed and presented to the work at pre-selected speed and depth of cut, automatically shifting at top stroke of the sensitive feed handle. Individual spindle settings also assure fine finish, accuracy and long tool life.



Job Facts

Company: Pelto Machine Company
Machine: Burgmaster Bench Model "O" 6-Spindle Turret Drill
Parts: Chrome-Nickel tool steel clutch components
Lots: 3900
Holding: Collet Centering Fixture
Former Time and Method: 24 pcs./hr. on a single spindle Chucker

Present Time: 120 pcs/hr.—a 400% increase

Operations:

Spindle No.	Operations	Spindle Speed
1	9/32 C'Drill	650
2	7/64 Drill	650
3	#25 Tap Drill	650
4	9/32 C'Bore	1700
5	10-32 Tap	650
6	Idle	650

Advantages: Increases production 400% —$595 Turret Drill replaces $8000 machine—less operator fatigue.

WRITE FOR LITERATURE covering Machines and Accessories. Also now available, the new Burgmaster AUTOMATIC Bench Model Turret Drill with power feed, and the new band Positioning Table Accessory. Dealers located in principle cities.

BURGMASTER CORPORATION

Small Tool Division — Burg Tool Manufacturing Co., Inc.
15001 So. Figueroa Street, Box 311
Gardena, California Phone: FAculty 1-3510

WORLD'S LARGEST MANUFACTURER OF TURRET TYPE DRILLING AND TAPPING MACHINES

CIRCLE INFORM-A-GRAM KEY NO. 763

An Economical Approach to Small Parts Inspection

ROBINS (model SG-66) SYL·A·SCOPE

Here, at last, is an instrument that provides rapid, precise inspections of small parts and tools up to 1/32" in diameter. Completely portable, the SG-66 can be transferred easily for on-the-spot inspections. Its low price permits the purchase of enough units to cover every critical inspection point in your plant . . .

The SYL-A-SCOPE is easy to operate: Simply plug it in to any standard electrical outlet — place the part to be inspected in the aperture — and switch it on. Instantly an illuminated, magnified silhouette (80 to 1 linear magnification) appears on the ground glass screen . . . highlighting every detail.

Specifications: Power Requirements—110 VAC, 60 cycles; Screen Size—2⅝"x2¼"; Dimensions —7"x5¼"x3⅞"; Sturdy Metal Case.

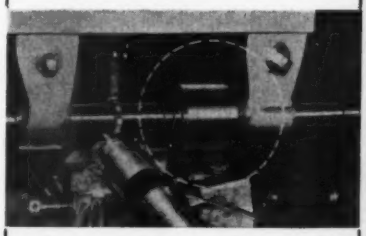
only $19.95

Write for literature. TP-4

ROBINS INDUSTRIES CORP. • FLUSHING 54, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 764

ELIMINATE MILLING MACHINE MAINTENANCE



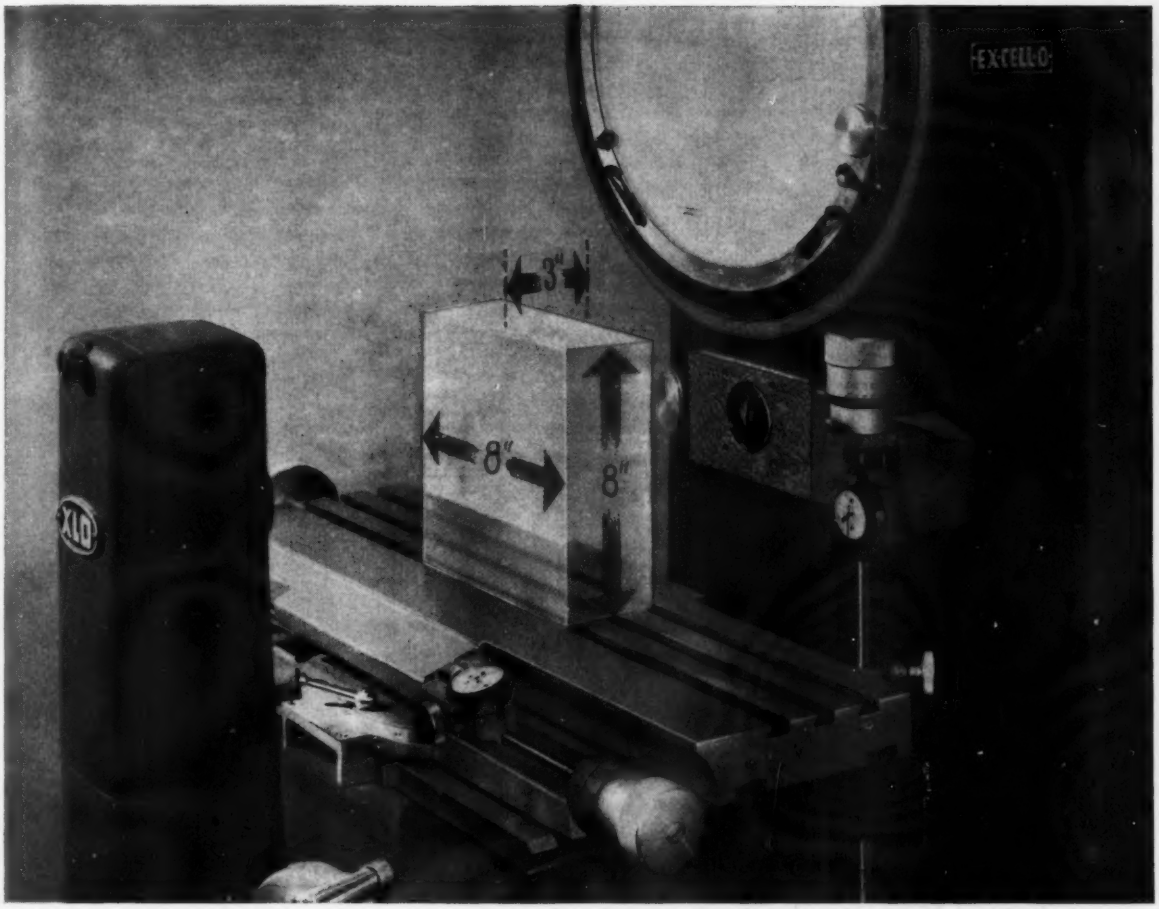
UPS FEEDS AND SPEEDS 200%

See how General Electric, Jeffrey Mfg., hundreds of others absolutely end arbor bushing maintenance problems and decrease production costs on horizontal milling machines by replacing the bronze outer support bushing with a Jergens "Live" Sealed Roller Bearing Unit. Jergens Units with adjustable roller bearings hold precision—permit increases in milling speeds and feeds to take full advantage of carbide cutters. The rigidity of these units increase cutter life and eliminate chatter, frozen bushings, and twisted arbors. See how hundreds save thousands! Write for FREE case histories of actual company performance reports of jobs and dollars saved.

DONLEY PRODUCTS, INC.

Dept. TP-4 11106 Avon Ave., Cleveland 5, O.

CIRCLE INFORM-A-GRAM KEY NO. 765



EX-CELL-O Contour Projectors Give You 98% More Capacity

Ex-Cell-O Models 14-5 and 30 give you capacity to accept and optically gage much larger parts than is possible with other contour projectors,—*and without repositioning on the table!*

A full 8" of table travel in both horizontal and vertical planes, together with 3" of focusing travel is standard on these Ex-Cell-O Models. Every point within this "block" can easily be brought into focus on the screen.

Here is real capacity,—192 cubic inches,—98% *more* than the nearest standard model! Enables users to stage shafts 16" in diameter, (and larger in some cases), and 16½" in length on the standard work table with standard centers. Any point along the part contour can be optically gaged with convenient table movement.

"Cubage" isn't the only Ex-Cell-O capacity Plus! You get constant 8" of working distance (lens to focal plane) —20% more than other standard projectors. Full 8" of vertical measuring travel. Constant throat clearance, (collimator lens to front projection lens), of 17½" on the Model 14-5; 16" on the Model 30;—and Ex-Cell-O's rugged, heavy duty tables enable you to stage parts weighing up to several hundred pounds.

When you are ready to talk about Contour Projectors, compare feature for feature! There is an OGP Representative near you to demonstrate Ex-Cell-O's many PLUS values. Call or write. In the meantime, let us send you "43 Reasons Why EX-CELL-O Contour Projectors are the First Choice of Industry."

You Can Purchase Ex-Cell-O Contour Projectors on Conventional Terms . . . Deferred Payment Plan . . . or Lease With or Without Purchase Option. Select the Plan Best Suited to Your Needs.

Manufactured by EX-CELL-O Corporation at Detroit, Mich.
SOLD AND SERVICED BY

OPTICAL GAGING PRODUCTS, INC.

26 FORBES STREET ROCHESTER 11, N. Y.
(A subsidiary of EX-CELL-O Corporation)

CIRCLE INFORM-A-GRAM KEY NO. 77

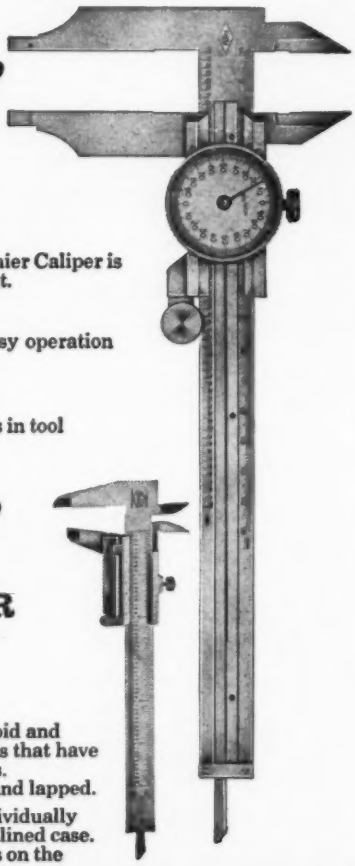
Catalogs and other helpful literature

Optical comparators and universal measuring machines by Jones & Lamson are the topic of a 60-page book. Along with catalog information, the book contains basic measuring demonstrations, and applications varying from electronic components to turbine blades. Inform-A-Gram No. C1.

Tips on proper application procedures and control equipment for maintaining spray booth systems are given in Folder F9443 by Oakite Products, Inc. Also listed are seven compounds that proved successful in treating a wide range of organic and synthetic coatings. Inform-A-Gram No. C2.

Eliminate costly reading errors with the

"HELIOS"
DIAL VERNIER CALIPER with built-in DIAL INDICATOR
Direct Reading in .001"



The world famous "HELIOS" Dial Vernier Caliper is hardened, ground and lapped throughout.

Other features:

- Thumb roll permits quick and easy operation
- Knurled lock screw
- 100% measuring capacity (outside, inside and depth.)

Available in 5", 6", 8" and 10" capacities in tool steel or stainless steel.

Height Gage Attachment optional.

"HELIOS"
SWING-JAW VERNIER CALIPER
with knurled lock screw

- Direct Reading
- Capacity 4¾"
- Length of Jaw 1⅝"

The swinging jaw allows a very easy, rapid and extremely accurate measurement of parts that have faces which do not lie along the same axis. This caliper is stainless steel, hardened and lapped.

Every "HELIOS" Vernier Caliper is individually packaged in a beautiful hardwood velvet-lined case. Write for detailed information and prices on the "HELIOS" Caliper line.

U.S. REPRESENTATIVES:
M. B. I. EXPORT & IMPORT LTD.
A DIVISION OF MACHINERY BUILDERS, INC.
475 Grand Concourse, Bronx 51, N. Y.
"Over 25 years' experience in designing and building machinery."

CIRCLE INFORM-A-GRAM KEY NO. 78

The Varistroke crankshaft with its wide work range is the subject of a booklet by Dechert Dynamics Corp. For your free copy circle Inform-A-Gram No. C3.

Condensed catalog 735 is available through Inform-A-Gram No. C4. Air and hydraulic clamping tools, accessories, air cylinders, full scale templates and the boosters by Wilton Tool Mfg. Co., Inc. are highlighted.

Circling Inform-A-Gram No. C5 will bring you Bulletin 54 from Niagara Machine & Tool Works. Subject of the brochure is the company's line of OBI presses for automatic, ultra-high speed operation with progressive dies.

A new 44-page catalog from the Wesson Company puts the spotlight on throw-away and conventional carbide milling cutters, accessories, blades, parts, and tools. Inform-A-Gram No. C6.

Inform-A-Gram No. C7 will bring you a product data sheet describing the physical properties of a water soluble base for heavy duty machining, by E. F. Houghton and Co.

Illuminated magnifiers and microscopes built by E. W. Pike & Co. are illustrated in a handy brochure. It's yours if you circle Inform-A-Gram No. C8.

The all-new Bickford 11" radial drilling machine is described in Bulletin BR-11 by Giddings & Lewis. Check Inform-A-Gram No. C9 for your copy.

Catalogs . . .

Wet permanent drum separators offered by Stearns Magnetic Products, are outlined in a catalog by that company. For your copy check Inform-A-Gram No. C10.

"Tool Steel Identifier" is offered by Universal-Cyclops Steel Corp. The tool steel slide rule reveals brand name, producer, AISI number and Universal-Cyclops equivalent brand. Inform-A-Gram No. C11.

A large anvil utility vise, designed specifically for rugged use, with replaceable pipe and top jaws is offered by Wilton Tool Mfg. Co. For descriptive literature mark Inform-A-Gram No. C12.

A 24-page selection guide to SPS bolts for the aerospace industries is offered by Standard Pressed Steel Co. Material selection, fabrication, quality control, heading practice, heat treatment, grinding, thread rolling and plating are covered. Inform-A-Gram No. C13.

Star Model 25 automatic-feed keyseater is described in a catalog by Star Cutter Co. Operating and design features are given, as well as specifications. Circle No. C14.

Small bore cylinders for air, oil, water, vacuum service with pneumatic pressure up to 150 psi and hydraulic pressure to 2000 psi, are catalogued by Airoyal Mfg. Co. Circle Inform-A-Gram No. C15.

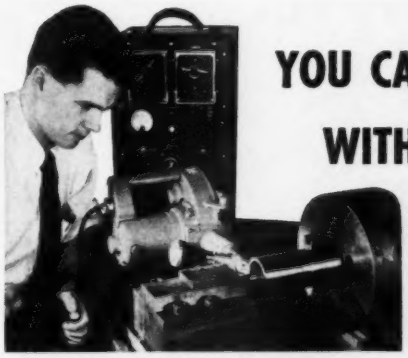
Electric infrared comfort heaters for direct radiant heating of machine, tool, and production shops are outlined in Bulletin CH-100 by Fostoria Corp. Circle C16.

Model 412 wet abrasive cutting machine for cutting materials from mild steel, to titanium, refractaloy, Rene 41, Incoloy 901, Waspaloy etc., is specified in Bulletin DH-63 by Allison - Campbell Division, American Chain & Cable Co., Inc. Circle Inform-A-Gram No. C17.

The new Bickford 30" upright drilling machine with a radial drill head is described in Bulletin BU-30 by Giddings & Lewis Machine Tool Co. Mark Inform-A-Gram No. C18.

A single machine or a complete plant can now be leased. Armstrong Leasing Corp. tells how it's done in two booklets entitled "Ready to Solve your Money Problems" and "Equipment Leasing Facts." Circle Inform-A-Gram No. C19.

Valcore crowned inflated wheels for deburring, chamfering, spotting, and contouring, are extolled in a catalog sheet by Nu-Matic Grinders, Inc. Mark Inform-A-Gram No. C20.

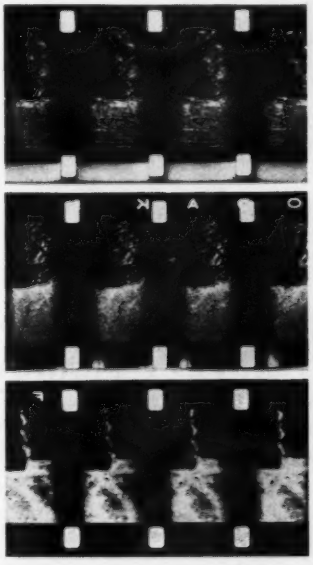


YOU CAN SEE WHY WITH FASTAX

PROBLEM: *Differences in power consumption, chip formation and tool life when machining Titanium and steel.*

SOLUTION: *A high speed motion picture study of chip formation process of SAE 1020 and SAE 1112 steel being machined under same conditions as Titanium.*

1: FASTAX High Speed Camera taking movies at 7,500 frames per second through a microscope. Actual frames from movies shown below.



2: SAE 1020 steel. Large built-up edge at cutting speed causes poor surface finish. Shear angle is low, resulting in very thick chip and consumption of considerable power in removing metal.

3: SAE 1112 steel. Built-up edge is absent due to lower friction on tool face . . . improved surface finish. Shear angle is higher and chip thinner. Power consumption is lessened.

4: TITANIUM (Ti 150A). No built-up edge. Surface finish is excellent. Shear angle high, but not constant in value. Chip forming process is cyclic. Since thin chip, power consumption is low. Tool life shorter because of metal structure.

This is just another industrial production problem solved through the eye of a FASTAX High Speed Motion Picture Camera—one of 26 different models available for solving *your* problems.

FOR THE FINEST IN PHOTOGRAPHY THE WORLD OVER — WOLLENSAK — IT'S WOLLENSAK

WRITE us your design or production problems. High Speed photography can be the answer. New bulletin available.

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OPTICAL COMPANY • ROCHESTER 21, N.Y.

CIRCLE INFORM-A-GRAM KEY NO. 79

THE Exclusive SET
FEATURING
SAFETY FLANGES
Everywhere you go you see Superior die sets . . . the finest in all the world.
Right, Sue Perior! And just look at the safety flanges . . . they're the last word in easy handling and safety. Only Superior has them!

Exclusive SAFETY FLANGES

Recognized as one of the greatest contributions to die set handling . . . all Superior die sets — large or small — are equipped with exclusive safety flanges . . . AT NO EXTRA COST. Use Superior die sets . . . they'll save you time and money!

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2754 South 19th Street • Milwaukee, Wisconsin
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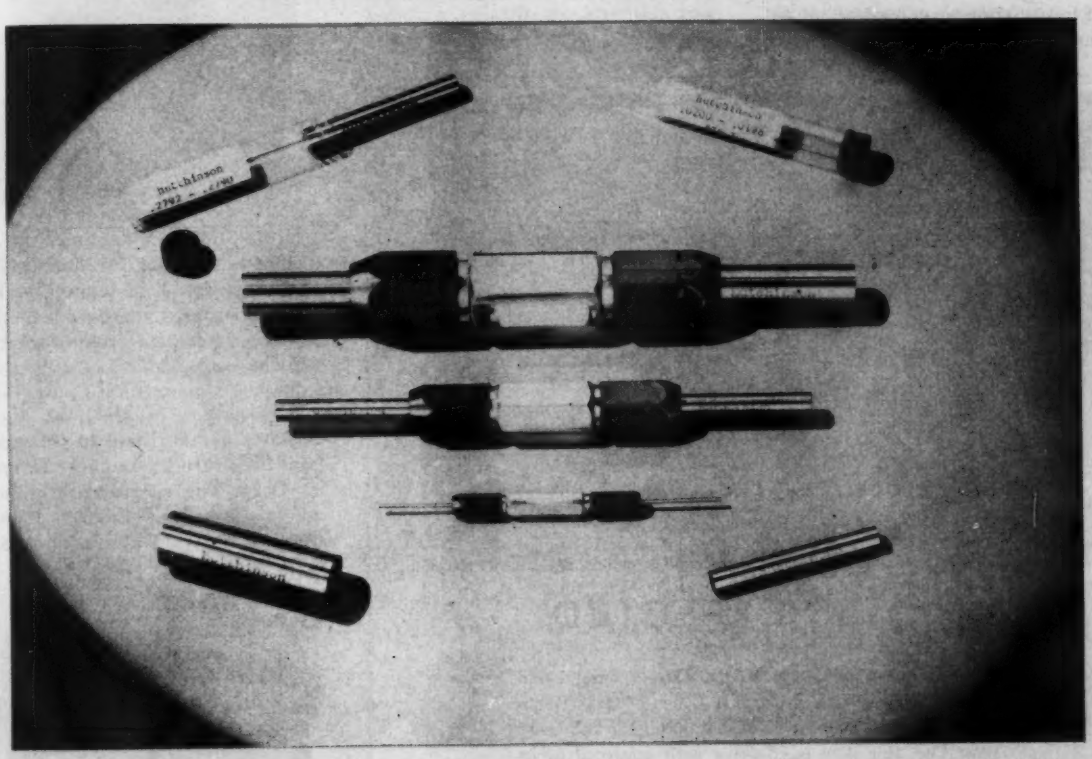
CIRCLE INFORM-A-GRAM KEY NO. 80

DRexel 6-4222 ESTABLISHED 1927

WILLIAM T. HUTCHINSON CO.

53 BROWN AVENUE SPRINGFIELD, NEW JERSEY

HUTCHINSON HSS BLANKS



SHORT LENGTHS FOR GAGES

M-2 HIGH SPEED STEEL — 64 "C" scale hard — gage tolerance — mirror finish — parallel ground.

	choice of two tolerances	
	+.0002	—.0000
or	+.0000	—.0002

ANY DECIMAL DIAMETER OF STANDARD LENGTH
.010" TO 1.000" SHIPPED ON 24 HOUR NOTICE

CIRCLE INFORM-A-GRAM KEY NO. 81

Catalogs . . .

Catalog JF-61 fully describes the new ABC jig and fixture components by Accurate Bushing Co. Companion literature is comprised of Price List JFP-61, Engineering Bulletin JFCR-61 with full scale template drawings, Cross Reference Bulletin JFCR-61, showing interchangeability of ABC clamps and many popular components. All yours on Inform-A-Gram No. C21.

"Feasibility Study of Large Dia Anti-Friction Bearings for Radar Antenna Applications" is the title of a new book from Kaydon Engineering Corp., Muskegon, Mich. The book sells for $25.00 and is available from the company direct.

Mo-Bar Hydraulics Co. has issued three bulletins 202, 203 and 204 on air cylinders and hydraulic cylinders. Check Inform-A-Gram No. C22.

DELIVERY
. . . AS EXPECTED

PROMISES YOU CAN BANK ON—Special event in the life of an Oberg Carbide Die is D-Day! When you commission Oberg to design, engineer and build your Die, this date is effective with approval of its final design details. Oberg engineers and craftsmen know and respect D-Day as thoroughly as they do the intricate parts of your Die. If requested, and material is supplied, your Oberg Carbide Die will be production-proved. You can plan to attend these tests for practical experience and the best operational practices. You'll find . . .

Oberg is something special

Oberg Manufacturing Co., INC.
FREEPORT, PA.

Send today for NEW *brochure describing Oberg carbide die services and facilities.*

BE SURE TO VISIT BOOTH 2146 at the ASTME 1961 Exposition in New York
CIRCLE INFORM-A-GRAM KEY NO. 82

"Tool Room Grinding" is the title of a 32-pager by Macklin Co., with description of wheel symbols and markings, tool room selection, bonds used in manufacturing wheels, etc. No. C23.

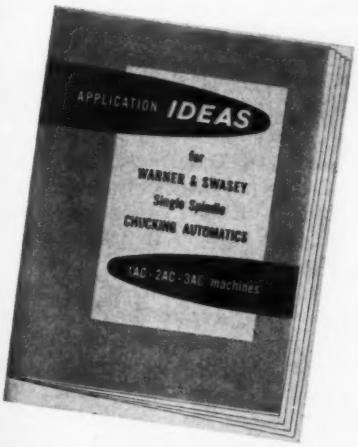
Advantages of the use of air clutches are outlined in an industrial brochure by Dechert Dynamics Corp. The exclusive air-clutch mechanisms available on Zeh & Hahnemann and Robinson industrial presses are highlighted. Inform-A-Gram No. C24.

Uniform symbols for drill bushings, adopted by the American Standards Assn., are used in a catalog by Ace Drill Bushing Co., Inc. Also included are 6800 old symbols with comparisons to the new A.S.A. system. For your free copy circle Inform-A-Gram No. C25.

Clamping cylinders are the subject of an illustrated bulletin by Airmatic Valve, Inc. Check Inform-A-Gram No. C26.

Catalogs . . .

Marking Inform-A-Gram No. C27 will bring you catalog 61 on solid carbide tools by Dexco Corp., Raymac Div. Featured are flat drills, plastic routers, a new line of boring bars, and speeds and feed charts, application information and surface charts.



"Ideas" galore in a new 32-pager by Warner & Swasey Co. The company presents interesting application ideas for its line of single spindle chucking automatics. Need Ideas? Then check Inform-A-Gram No. C28.

Alloy steel government specification analyses are available in convenient chart form from Peter A. Frasse Co. Specified forms of sheets, bars, tubings etc. and nearest corresponding SAE, AISI and AMS numbers are also listed. Interested? Check Inform-A-Gram No. C29.

Three grades of precision ground stock are outlined in an illustrated folder. Also explained are the advantages of using precision ground stock. Folders are available from Vanadium-Alloys Steel Co., by circling Inform-A-Gram No. C30.

Machinable steel-bonded carbides, and how they solved typical tooling problems, are both explained and illustrated in a manual from Sintercast Div., Chromalloy Corp., Circle Inform-A-Gram No. C31.

Boring, tracing, facing, turning and grooving are the fortes of new vertical turners by Motch & Merryweather Co. The building block principle for versatility and accuracy is also described. For your free catalog check Inform-A-Gram No. C32.

Abrasive cut-off wheels, for production cutting use as well as general use in toolrooms and machine shops, are detailed in a catalog from Simonds Abrasive Co. Inform-A-Gram No. C33.

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LESS HANDLING — FASTER OUTPUT
LOWER COST WITH THESE SYNTRON
VIBRATORY
BARREL FINISHING MACHINES
A NEW CONCEPT IN PARTS FINISHING!

NEW HIGH SPEED, COMPACT ELECTROMAGNETIC UNITS

—produce 3600 controllable vibrations per minute creating a gentle and total agitation between the parts and media. Finish delicate, difficult, or heavy parts faster at lower costs.

The simple electromagnetic design assures fast, effective, dependable action and low maintenance.

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Fast, easy! Inspect parts while work cycle continues.

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One control to vary amplitude.

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Connect hose; flush out compound.

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Lapping Machines
Bin Vibrators
Vibratory Feeders

CIRCLE INFORM-A-GRAM KEY NO. 83

Catalogs . . .

Fused Quartz Radiant Ovens for the "Finish that Lasts" is the title of a catalog from Cleveland Process Corp. Circle No. C34.

Molykote PVE, a new bonded molybdenum disulfide lubricant for use on cutting tools and heavily loaded ferrous bearing surfaces is outlined in a data sheet from Alpha Molykote Corp. Inform-A-Gram No. C35.

Harvey Aluminum Co. offers a brochure on aluminum forgings including precision, conventional, no-draft, blocker-type, hand, smith, and impact as well as rolled rings and forged fittings. Inform-A-Gram No. C36.

Auto-Tran is a straight-line indexing machine chassis with self-contained drive unit for continuous or intermittent work transfer and rigid base for mounting operational tooling. Brochure from Swanson-Erie Corp., or Circle No. C37.

Profit-Seeking

HEAD-HUNTERS

(Drill Head Hunters, that is)

Prefer the U. S. "PACKAGE" DEAL!

HERE'S THE PACKAGE:

A = Universal Joint Drill Head
B = Standard Adjustable Arms
C = Slip Spindle Plate (to suit your drilling pattern)
D = Fixture Adaptor Base
E = Fixture Insert (to suit your work pieces)

NOW APPLY THE FORMULAS FOR PROFITABLE DRILLING AND TAPPING

A + B = Adjustable Head versatility for short runs.

A + C = Fixed Head advantages for production runs.

A + C + D + E = Complete fixture and head package for more profitable production on long runs.

— and, it's all done with the one head!

Have your engineers talk with ours about U. S. Heads for your jobs.

Adjustable and Fixed Center Multiple Drilling Heads— Individual Lead Screw Multiple Tapping Heads

US DRILL HEAD

UNITED STATES DRILL HEAD CO.

5298 RIVER RD., CINCINNATI 33, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 84

Kamset, a precision boring cutter that works with throwaway inserts to develop fine finishes and boring tolerances in tenths, gains attention in a 24-pager by Valenite Metals. Circle Inform-A-Gram No. C38.

Catalog 308 described the Bendix line of numerical controls such as DynaPath-20 contouring controls and DynaPoint-20 and Ferranti positioning control. Published by Industrial Controls Section Bendix Corp. Inform-A-Gram No. C39.

A usage and instruction sheet on Metex T-103 metal cleaner for removal of oil and grease from steel, copper and brass is available from MacDermid, Inc. Inform-A-Gram No. C40.

Select-O-Graph, a wall chart with full-color graphs showing chief characteristics of 23 tool steels, is offered by Atlas Steels, Ltd. Also included is a brochure that repeats the graphs along with complete technical information. Inform-A-Gram No. C41.

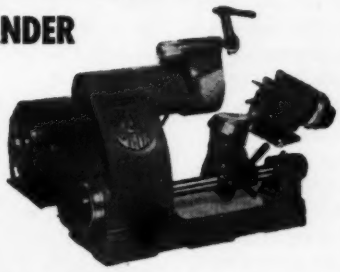
Chopped reflected light achieves reliable tape reading and stable operation on a photoelectric tape reader by Omnitronics, Inc. Details are provided in the company's Bulletin PRT-7. Inform-A-Gram No. C42.

A specification sheet details the new split capacitor, fractional horsepower AC motor by Leece-Neville Co. Available in ratings from 1/15 to 1/2 hp, the motor is built to operate under severe conditions. Inform-A-Gram No. C43.

Tool geometry, dimensions, and special features of two new boring bars are featured in a flyer from Valenite Metals. Available from 1.375 to 2.750" minimum bore diameters, the bars use throwaway inserts and adjustable chipbreakers. Inform-A-Gram No. C44.

Hydraulic and pneumatic accumulators, actuators, couplings, cylinders, power units, valves and others are included in a 150-pager that expounds the pumps and components made by Kenett Corp. Inform-A-Gram No. C45.

Accurate Cutter Sharpening With ALEXANDER Bench Grinders



Handles Extremely Small Radii

This Cutter Grinder provides precision forming of all single-lip cutters and tracing styles to any predetermined profile or cutting angle—on symmetrical or off-set radii. Work head is mounted on bar slide which permits coarse and fine longitudinal adjustments, and controlled oscillating movement. Two swivel bearings in work arm allow further vertical and horizontal adjustment. Collet attachment on index head accepts cutters up to ½" dia. Optional diamond wheel dressing attachment. Prompt delivery.

Write for catalog D on ALEXANDER Cutter Grinders, Die Sinkers and Engraving Machines.

J. ARTHUR DEAKIN, INC.

31 ROSELAND AVE. CALDWELL, N. J.

CIRCLE INFORM-A-GRAM KEY NO. 851

CUT REJECTS . . . BOOST PRODUCTION . . . with CHALLENGE Precision surface equipment

Challenge offers more than 300 different types and sizes of Precision Surface Equipment to help you maintain close control of accuracy in your tooling, manufacturing assembly and inspection operations.

Send for *FREE CATALOG* and prices! Ask for Catalog 840. Get prompt delivery from your local industrial distributor.

THE CHALLENGE MACHINERY CO.
GRAND HAVEN, MICH.

CIRCLE INFORM-A-GRAM KEY NO. 852

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EPOXY PLASTICS

for tooling, pattern making and fixtures

REN epoxy plastic materials for tooling, fixtures, master model and pattern making can save up to 50% in man-hours and material costs. REN products offer constant batch-to-batch uniformity and high quality . . . in a wide range of formulations to fit application requirements exactly.

REN-Wood model faced with REN-Shape, showing type of construction. (Built by Aero-Detroit Inc., Detroit, Mich.)

REN-Wood
A highly uniform, dimensionally stable, completely carvable plastic material for master model and pattern making. Savings result from 100% usability and defect-free composition.

REN-Shape
A fast-curing, carvable epoxy paste material featuring easy workability and dimensional stability. It provides a fast, accurate method of building and duplicating male and female parts, or as a repair or rebuilding material.

At no obligation, send today for your subscription to REN's bi-monthly publication, Tech-Ni-Tips/Tooling Digest.

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lansing 9, michigan

CIRCLE INFORM-A-GRAM KEY NO. 853

Catalogs . . .

Rivett Lathe & Grinder, Inc., has published an illustrative and descriptive bulletin on the company's series 60 precision turret lathe. Inform-A-Gram No. C46.

A liquid acid electropolish material that works on carbon steel, aluminum and stainless steel is described in Technical Data Sheet 81 by MacDermid, Inc. Inform-A-Gram No. C47.

Model 350 punched tape reader, for use with Control Data Corp's 1604 and 160 computers, is the subject of a brochure. This unit is said to read 5, 7, or 8 level punched paper tape at a rate of 350 characters/sec. No. C48.

Ultrasonic degreasing and cleaning applications and equipment by Phillips Mfg. Co., take the spotlight in Bulletin 23 by that company. Circle Inform-A-Gram No. C49.

"Economic Automation Processes" in soft soldering and silver brazing are divulged in a new brochure by Fusion Engineering. Circle Inform-A-Gram No. C50.

"Successful Supervision" is the thought-provoking title of a presentation by Elliot Service Co., Inc., publisher of industrial management aids. Mark Inform-A-Gram No. C51.

Bulletin 631 tells "How to Measure and Relate Pipe, Tubing and Hose Sizes." Produced by Aeroquip Corp., it's yours for circling Inform-A-Gram No. C52.

A bulletin on depth gages and adjustable length gages is available from Unigage Corp. Interested? Then circle Inform-A-Gram No. C53.

Model 4G dry drill grinder is described in bulletin 4000-A by Farrel-Birmingham Co., Inc. Circle Inform-A-Gram No. C54.

"Three Keys to Satisfaction," a 77-page revised guide to proper steel selection is offered by Climax Molybdenum Co. For yours check Inform-A-Gram No. C55.

Livernois Engineering Co. offers a brochure on transfer units. Included is the firm's complete line of mechanical or cylinder actuator in-line transfer equipment. Inform-A-Gram No. C56.

Johnson Model J (Wet or Dry) Cuts anything in your stock pile. 10" rounds, 18" flats, structurals or odd shapes. Centralized controls, special safety features, variable speeds.

that costs you NOTHING!

True, you pay the low initial purchase price, but the big, rugged Johnson Model J is so well engineered, so dependable, so troublefree—so versatile, fast and accurate, that it quickly pays for itself in tangible savings. One Johnson metal cutting band saw . . . or a battery of them, will pay you big dividends in time, labor—smooth production and eliminate scrap.

Write Today . . . for your copy of the new Johnson catalog.
All models and accessories described, illustrated in full.

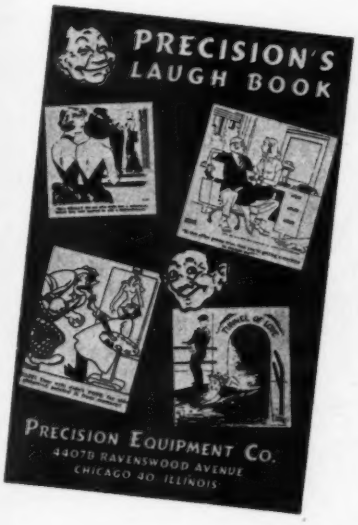
Johnson MANUFACTURING CORPORATION
1015 BARNES STREET, ALBION, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 86

BUY
U. S. SAVINGS BONDS
TODAY!

Catalogs . . .

Checking Inform-A-Gram No. C57 will bring you Bray Oil Co.'s new "Mil-Spec Catalog." Users of specification products in fields of lubrication, hydraulics, corrosion prevention and similar specialized areas should find it resourceful.



Strictly for laughs is a gleeful booklet by Precision Equipment Co., 4407B Ravenswood Ave., Chicago 40, Ill. Luncheon speakers and other public orators should find it helpful. Please order direct.

"Straight Grinders, Air Powered" is the name of a bulletin by Rotor Tool Co. Complete specifications on standard 4" and light and heavy duty grinders and buffers with internal blade motors, are included. Check Inform-A-Gram No. C58.

Automatic polishing and buffing machines are set forth in five new descriptive catalog sheets from Packer Machine Co. Also included are production rates, buff heads, wheels, head adjustments, stand adjustments, motors, controls, etc. Inform-A-Gram No. C59.

An 84-pager by Boice Gages, Inc., shows how standard Boice components can be incorporated in special and unusual gaging assemblies. Simple solutions to many common gaging problems are shown. Circle No. C60 for "Ideas."

The story of Mobil D.T.E. hydraulic oils is told in a booklet. Along with application stories and engineering service data, there is a section on their oxidation stability, prevention of wear, demulsibility, resistance to foaming and rust prevention. Inform-A-Gram No. C61.

Catalog 1161CJ by Universal Vise & Tool Co., tells of "Ten Ways to Make Setups Easier-Quicker." Mark Inform-A-Gram No. C62.

Precision cylindrical grinders from Landis Tool Co. are featured in Catalog CG-60. For your copy circle Inform-A-Gram No. C63.

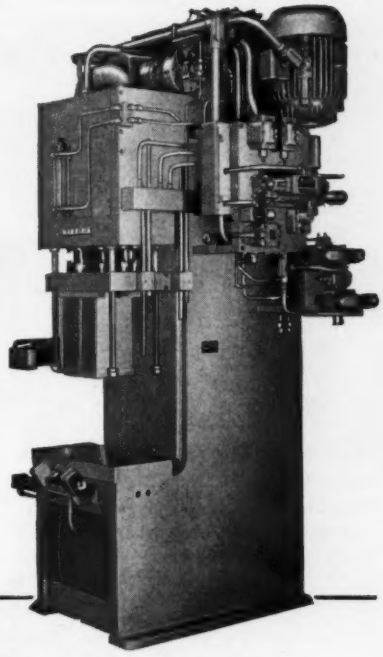
Bulletin 60 by Pedrick Tool & Machine Co., Inc., tells of that company's production bending machines using the compression method. Charts on section moduli of pipes, tube and bar and tensile strengths are also included. Inform-A-Gram No. C64.

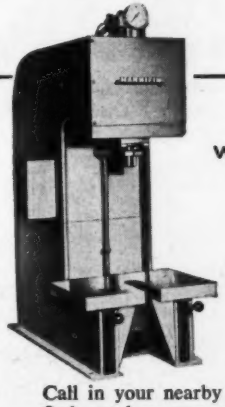
ON YOUR PRODUCTION LINE

Get pressure where you need it with a

HANNIFIN
FORCING PRESS

150 TONS to 1 TON
•
GAP OR COLUMN TYPES
•
HIGH SPEEDS • LOW PRICES





WITH THESE FEATURES:

1. All-steel welded frames—normalized.
2. Steel-head, heavy-duty cylinders.
3. Induction case-hardened rams.
4. Wide choice of ram speeds.
5. Built-in power units.
6. Wide choice of controls.
7. Special loading and unloading mechanisms where needed.

Call in your nearby Hannifin man—he's a trained production analyst—find out how you can do more at lower costs with Hannifin presses. Or, write for our new Bulletin 130-G. It tells the whole story.

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A DIVISION
563 South Wolf Road • Des Plaines, Illinois

PNEUMATIC AND HYDRAULIC SYSTEM COMPONENTS

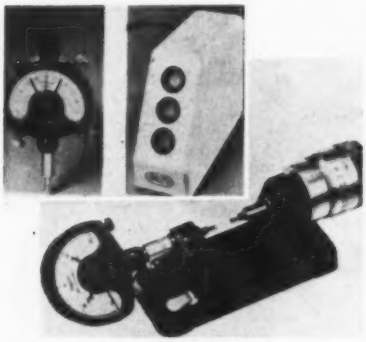
EUROPEAN DIVISION • PARKER-HANNIFIN N.V. • SCHIPHOL • THE NETHERLANDS

CIRCLE INFORM-A-GRAM KEY NO. 87

Product News

Precision Measuring

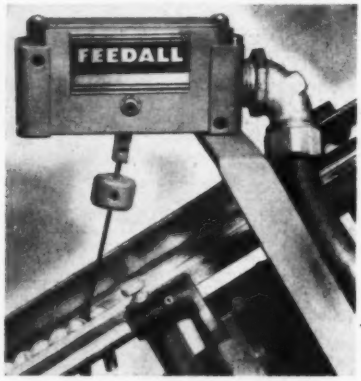
A small indicating bench micrometer works with 11 different types of interchangeable anvils. This makes the instrument valuable in quality control of precise parts in the watch, instrument, or electronics industry. With 1" measuring capacity, the unit reads directly in 50 millionths or 20 millionths, since it boasts an interchangeable comparator head as



well. For speedier mass inspection Mahr Gage Co., Inc., 274 Lafayette St., New York 12, N.Y., recommends Mahr comparator heads with built-in electric limit contacts, connected to a light signal attachment with 3 signal lights. For additional data write the company or mark No. P1.

Keeps Them Moving

Feedall 110 is a pressure-actuated control switch that regulates flow rate of moving parts. The model measures $1\frac{7}{16}$ x $1\frac{13}{16}$" and weighs only 12 oz. It is made by Feedall, Inc., 38399 Pelton Rd., Willoughby, Ohio. It employs pressure moving workpieces to maintain desired flow rate, and a counter weight on the sensing arm permits slight adjustment of the actuating pressure. Applications include use for non-magnetic materials on heavy-duty construction, on parts feeders, conveyors, spe-



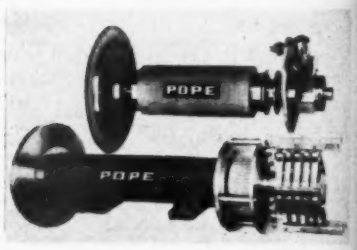
cial operation machines and handling equipment. Circle Inform-A-Gram No. P3.

Bantam Clamp

A small clamp with the 1-ton grip of a giant releases with the flick of a finger. Called Han-D-Vise, the tool works as a clamp, wrench, vise or plier with a maximum jaw opening of $1\frac{1}{4}$". Manufactured by Detroit Stamping Co., 330 Midland Ave., Detroit 3, Mich., in 7 and 10" sizes, with or without quick action trigger release. Write the maker, or mark No. P4.

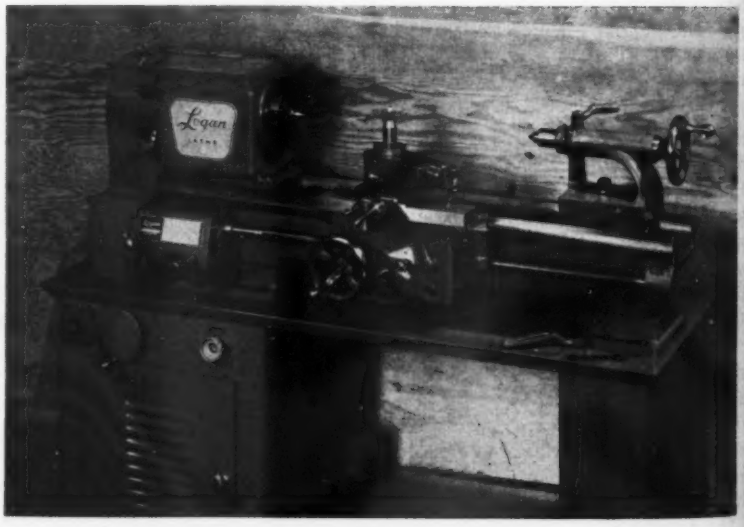
Speedier Spindles

Running the gamut from 50 to 3000 amps operational range, new Pope "Anocut" electrolytic grinding spindles are marketed either motorized or belt driven. Insulation is built in, and spindles feature rugged, fork-type brush assembly for cool operation. For application data write Pope Machinery Corp., 261 River St., Haverhill, Mass., or circle P5.



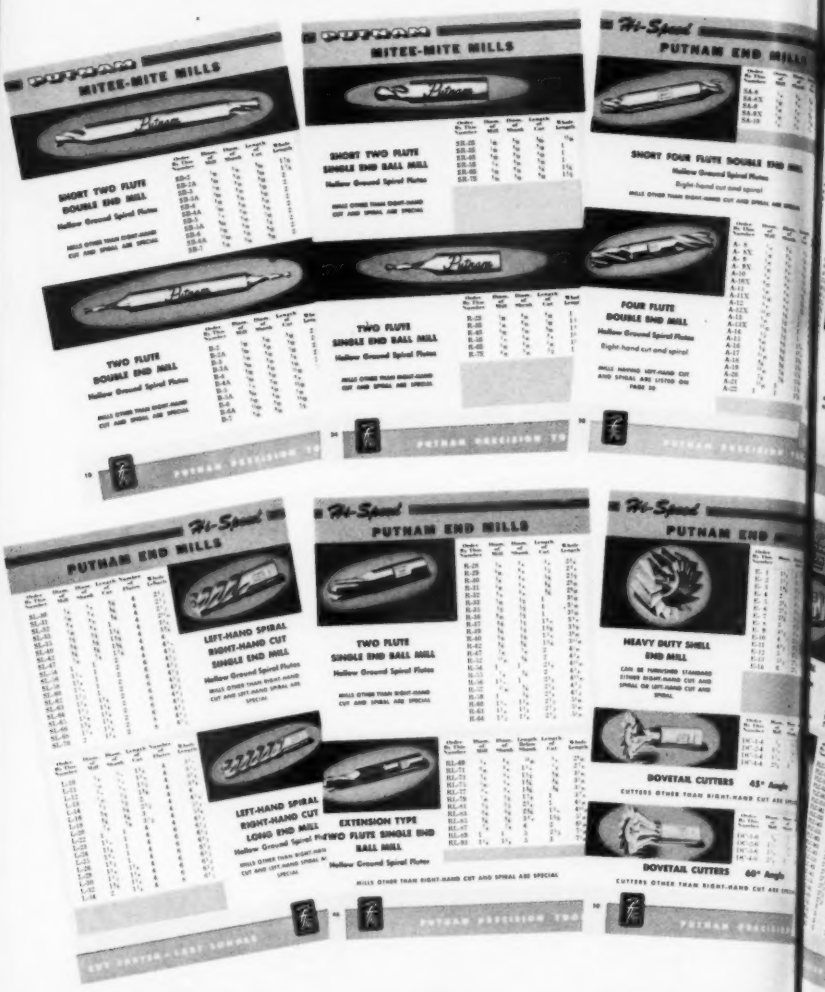
Shifting Not Necessary

A new series of 14" swing lathes features variable speed drive of 40 to 1400 rpm and instant speed adjustment without shifting the belt. With $14\frac{5}{8}$" swing over beds, 9"swing saddle cross slides, center distances of 28" and two precision ground V-ways, the lathes are manufactured by Logan Engineering Co., 4901 W. Lawrence Ave., Chicago 30, Ill. Hardened steel spindle with a $1\frac{3}{8}$" hole and a draw-in collet capacity of $1\frac{1}{16}$" are other features. The models are available with $2\frac{1}{4}$"-8 thread spindle and L-00 spindles with either standard or hardened beds. Particulars from the company or through Inform-A-Gram No. P2.



This NEW Catalog

. . . lists the country's most complete line of end mills


PUTNAM
MITEE-MITE MILLS
SHORT TWO FLUTE DOUBLE END MILL
Hollow Ground Spiral Flutes
SHORT TWO FLUTE SINGLE END BALL MILL
Hollow Ground Spiral Flutes
Hi-Speed
PUTNAM END MILLS
SHORT FOUR FLUTE DOUBLE END MILL
Hollow Ground Spiral Flutes
Right-hand cut and spiral
TWO FLUTE DOUBLE END MILL
Hollow Ground Spiral Flutes
TWO FLUTE SINGLE END BALL MILL
Hollow Ground Spiral Flutes
FOUR FLUTE DOUBLE END MILL
Hollow Ground Spiral Flutes
Right-hand cut and spiral
PUTNAM END MILLS
LEFT-HAND SPIRAL RIGHT-HAND CUT SINGLE END MILL
Hollow Ground Spiral Flutes
LEFT-HAND SPIRAL RIGHT-HAND CUT LONG END MILL
Hollow Ground Spiral Flutes
PUTNAM END MILLS
TWO FLUTE SINGLE END BALL MILL
Hollow Ground Spiral Flutes
EXTENSION TYPE TWO FLUTE SINGLE END BALL MILL
Hollow Ground Spiral Flutes
PUTNAM END MILLS
HEAVY DUTY SHELL END MILL
DOVETAIL CUTTERS 45° Angle
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NOW! Send for your Putnam Catalog

THE BOOK DESIGNED TO FIT ANY TOOL BOX

Over 1800 Standard Types & Sizes of Putnam End Mills

Now! You can order standard end mills ranging in diameter from 1/32″ to 6″ and get off-the-shelf delivery. In the Putnam line of over 1800 standard types and sizes are many end mills that are considered as "specials" by other manufacturers.

Regardless of your requirements, there probably is a Putnam standard end mill that will exactly meet your needs. You can get all the superior Putnam cutting qualities for milling: intricate shapes, deep cuts, tough materials, aluminum, etc. – without purchasing costly specials.

Contact your local Putnam Distributor, he will recommend the best end mill for each specific job and give you quick delivery from his stock.

(Please write on your company letterhead)

A plant that specializes in the manufacture of end mills

Putnam end mills are made by specialists who work
a modern plant having the finest equipment availabl
Every end mill is machined from high speed steels
rigid Putnam analysis, heat-treated in our own plant a
produced under close quality control. Because *end mil*
are our business, we carefully guard their reputation f
quality and performance with individual inspection
a score of important details.

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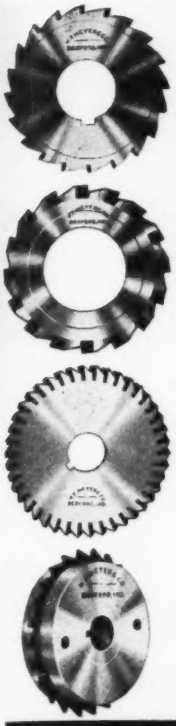
IN CITIES
COAST TO COA



Carbide Tipped and Solid Carbide Circular CUTTING TOOLS

MEYERS works to tolerances of .0001″; makes tipped cutters as thin as .030″, solid carbide cutters much thinner; diameters of ¼″ and up.

The finest quality and proper grade of tungsten carbide is engineered to the cutter's job. Tools are precision ground and lapped for long life, tipped to carefully tempered and ground bodies.

• It costs no more to enjoy the production advantages of MEYCO tools: "precision" minded since 1888, careful workmanship, well equipped shops and capable design engineers . . . all add up to plus values for you.

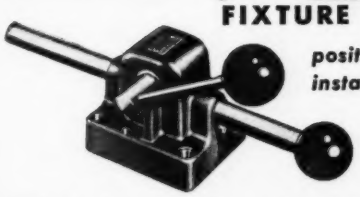
SPECIALISTS—Your special problems in the field of cutting, slitting, slotting, under-cutting or form-cutting are solicited.

Write for New Cutter Catalog No. 51

MEYCO **W. F. MEYERS CO., Inc.**
BEDFORD, INDIANA
A famous name in precision tools since 1888

CIRCLE INFORM-A-GRAM KEY NO. 931

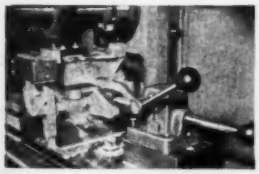
heinrich *Grip-Master* FIXTURE LOCKS

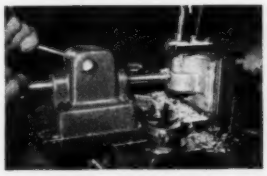


positive clamping instant setting

SIMPLIFY JIG AND FIXTURE DESIGN

LONG TRAVEL provides plenty of chip clearance, easy loading and unloading. Gets into hard-to-reach places. Base sizes: Model 2FL, 3⅜″ x 3¼″; Model 9FL, 4⅜″ x 3⅝″. Bar lengths from 8″ to 18″. Here are two examples of Grip-Masters speeding production in drilling and milling operations.





See Your Industrial Distributor or Send for Big, Free Catalog on Heinrich Tools

HEINRICH TOOLS INC., DEPT. 131-D
RACINE, WISCONSIN

CIRCLE INFORM-A-GRAM KEY NO. 932

CIRCLE INFORM-A-GRAM KEY NO. 92

faster changeovers boost press production

Whistler Magnetic Perforating Dies feature interchangeable parts fastened to steel templates which are patterned to the stamping. Punches and dies are assembled and disassembled in templates on an assembly bench while the presses are working on other production.

- **REDUCE DIE COSTS:** In one plant, over 1500 operations (for parts up to 3′ x 5′) have been tooled up at an average cost of $200 each.
- **EXTEND PUNCH AND DIE LIFE**
- **SAVE STORAGE SPACE**
- **ELIMINATE DELIVERY DELAYS:** Punches and dies stocked in .001″ increments from .100″ to .500″ diameters. Other sizes in stock up to 3″.

GET THE TIME AND MONEY SAVING STORY ON WHISTLER PRODUCTS:
magnetic dies • adjustable dies • custom dies

S. B. WHISTLER & SONS, INC.
748 Military Road, Buffalo 23, N. Y.

mail the following:
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☐ Adjustable Die Catalog
☐ Custom Die Bulletin

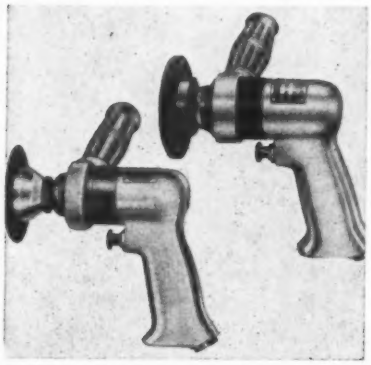
NAME _____ TITLE _____
COMPANY _____
STREET _____
CITY _____ ZONE _____ STATE _____

CIRCLE INFORM-A-GRAM KEY NO. 933

Product News

Pistol Packing Tools

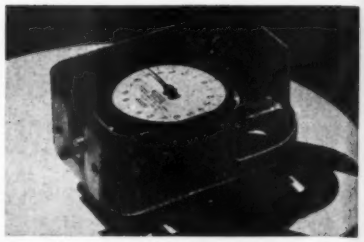
Accurate, one-hand pistol-grip control over general duty finishing tasks is promised with series 31V and 31S sanders and grinders by Buckeye Tools Corp., 5003 Springboro Pike, Dayton 1, Ohio. For more difficult operations a removable adjustable dead handle is furnished with each model. The 31V grinder has a 3″ wheel capacity, weighs 1⅞ lbs and is 5½″ long minus the wheel. Its ⅜″-24 spindle turns at 18,000 rpm. The



31S-140 sander has 3″ disc capacity, is 6¼″ long and weighs 2 lbs. It operates at 20,000 rpm and boasts a clamping washer and adapter as standard equipment, while the grinder features adapter and depressed center wheels. For additional data contact the company, or check P6.

Gaging Guards

Designing, detailing and building individual indicator housings for gaging jobs is passe. New standard housings built by AA Industries, Inc., 350 Fair St., Ferndale 20, Mich., are said to provide maximum protection and easy access. Available in two sizes, the precision aluminum die-cast guards are 90° through-type dial indicators 2¼″ dia or less. The elongated bracket mounting hole for the indicator permits back-and-forth ad-



justment of 1″. Housings can be mounted vertically or horizontally, using ¼-20 tapped holes. Write directly, or check Inform-A-Gram No. P8.

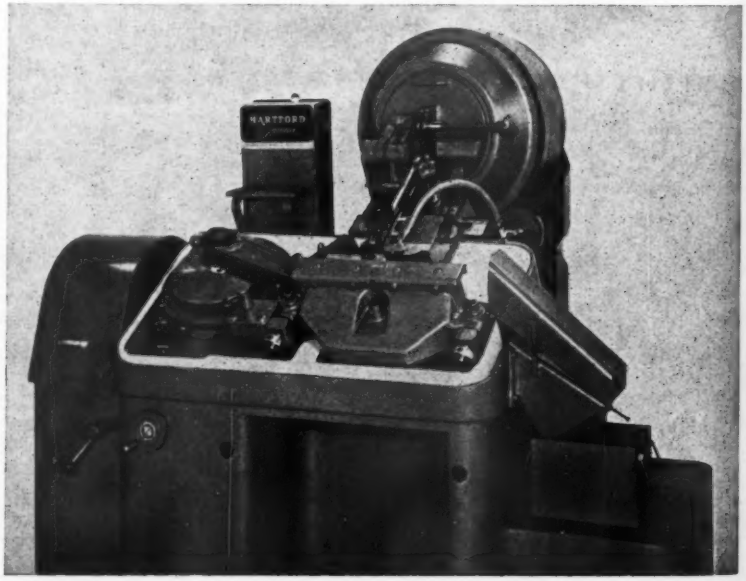
Calculation Takes Short Cut

The Curta Co., 14435 Cohasset St., Van Nuys, Calif., designed a new calculator. The reel type, pocket-size instrument boasts a keyboard with 11 digits, 8 on the indicator dial and 15 digits (corresponding to 99 trillion) on the answer dial. Of stainless steel and anodized aluminum, the cylindrical calculator provides on-the-spot mathematical answers for designers, engineers and technicians. The calculator has continuous tens transfer and reversing lever permitting short-cuts in multiplication, division, addition, subtraction, cubes, roots, percentiles and trigonometry. Automatic stops prevent errors or damage from overspeeding. More on the 12 oz, 1 1/16″ dia by 3⅜″ high computer from the

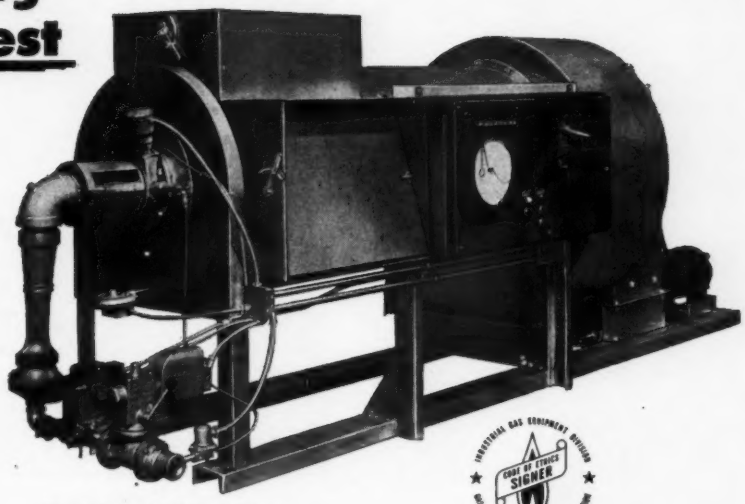
maker, or through Inform-A-Gram No. P9.

Automatic Thread Rolling

Model 400-R by Hartford Special Machinery Co., Simsbury, Conn., will produce from 135 to 400 threads/min. A large hopper boasts infinitely adjustable speeds from 4.5 to 11.5 rpm. Thread lengths may be rolled from ⅛ through 1½″ and can be extended through 3″ via special dies. Screw capacity is from #2 through 10 on 400-M manual. Both models feature adjustable starter fingers allowing for variation of height and stroke. A simple eccentric cam adjustment controls the relative position of the moving die for easy die machining. Die spacing can be precisely adjusted through longer spacing between adjusting screws. Write the maker, or mark Inform-A-Gram No. P7.



Heat Processing with NEW G. A. S. UTILITY AIR HEATER at its best



A complete package unit, modern as tomorrow in both design and performance, this new direct gas-fired line of industrial heaters comes to you complete with control cabinet, temperature and safety instruments, fan and motor, wired for immediate operation. Can be furnished for remote control wiring. Capacities range from 125,000 BTU's/hr., to 4,000,000 BTU's/hrs.,—temperatures to 600°F. in standard models and to 1,000°F., in famous G.A.S. Rapidry Models. Features injector type atmospheric type burners (combination gas-oil burners when desired), heavy-duty industrial type blower, and electrical ignition. Exceptionally quiet operation.

Model 409H illustrated.
Capacity 2,000,000 BTU's/hr.
Complete with controls.

Request complete information.

GAS APPLIANCE SERVICE, INC.
Heat Process Engineers
1936 West Balmoral Avenue, Chicago 40, Illinois
Representatives in Major Industrial Areas

CIRCLE INFORM-A-GRAM KEY NO. 951

How To Size And Finish More Holes Per Dollar

In brief: *Ballize* them.

Ballizing brings holes to size in *seconds*, with high precision and fine finish — *faster* and at *far less cost* than any other method — simply by forcing a precision ball through the unfinished hole.

This process uses *any* machine having a ram or push rod — has no close adjustments or tool maintenance — uses unskilled labor — cuts scrap and inspection costs. It saves and saves.

FREE BALLIZING BULLETIN gives full details; shows typical setups; gives cost and production data. *Write for it!*

INDUSTRIAL TECTONICS, INC.
MANUFACTURERS OF PRECISION BALLS AND BEARINGS
BALL DIVISION: 3686 JACKSON RD.
ANN ARBOR 4, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 952

AIR-MITE AIR CYLINDERS

★COMPACT ★POWERFUL ★RUGGED ★LOW COST

AIR-MITE Cylinders—made in Single or Double Acting Series, in 4 mounting types, are high quality cylinders at a low price. Simple, rugged design and compact construction give them long life, permit easy mounting on jigs, fixtures, tools, or machines. Used wherever power holding, pushing, pulling, or lifting is required, AIR-MITE Cylinders will meet your most exacting requirements of dependability and long life. Write for complete catalog and prices.

QUALITY FEATURES:
1. Ground and polished steel ram
2. Bronze oilless ram bushing
3. High strength aluminum alloy cylinder heads
4. Brass, true-bore cylinders
5. Five steel tie rods

92

AIR-MITE DEVICES, INC.
4405 W. Kinzie St. Chicago 24, Ill.

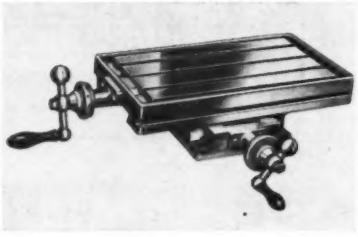
CIRCLE INFORM-A-GRAM KEY NO. 953

Product News

Speedier Settings

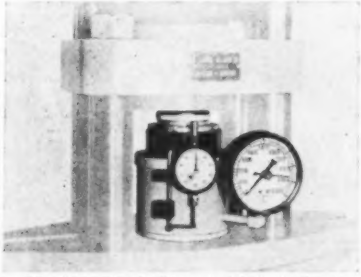
This optical tool setting comparator sets tool depth and diameter, and checks tool runout and cutting edge on any cutting tool used on numerical or manually controlled machines. Built by Pratt & Whitney Co., Inc., West Hartford, Conn., the gage can handle straight or tapered tool shanks by means of an interchangeable adapter. It uses a set of reliable gage blocks and end measures for even inch settings. Accuracy of 0.0001 is feasible since settings are made through a high-powered microscope. Maximum depth and diameter capacities are 12 and 6″ respectively. For additional information write the manufacturer, or circle Inform-A-No. P11.

Compound Milling Table



A compound milling table for end-mills up to ½″ dia and for jig boring of medium accuracy, is offered by Boice-Crane Co., 963 W. Central Ave., Toledo 6, Ohio. The milling table has ground work surface size 22½ x 9½″ fitted with two T-slots, perimeter coolant trough, and a third T-slot in the front vertical surface. Longitudinal feed is 14¾″, and the cross feed 6½″. The longitudinal and cross slide saddles are scraped, fitting with both gib adjustment and adjustable stops, over-all height is 4⁵⁄₁₆″. Usable on Boice-Crane 18, 24, and 25½″ geared head drill presses, the table also adapts to any press with 2⅜″ bored table-knee. Write the company, or circle Inform-A-Gram No. P12.

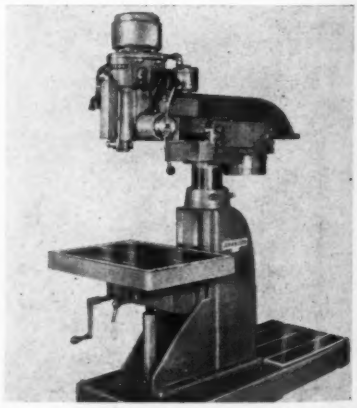
Sheet Metal Tester Cell



Model CTC Sheet Metal Tester Cell by Detroit Testing Machine Co., 9390 Grinnell Ave., Detroit 13, Mich., makes ductility tests on sheet metal up to ⅛″ thickness. The compact unit weighs 22 lbs and may be used in conjunction with a wide variety of compression loading equipment for performing ball punch and cut type ductility tests. Write the company, or circle Inform-A-Gram No. P10.

Swinging Radial Arm

A machine to fill the gap between sensitive upright drills and a large radial drill has been built by I. O. Johansson Co., Skokie, Ill. The precision radial drilling machine features an arm that swings through 360° for positioning. There are two work locations, a 20 x 40″ work table at the front and a 25 x 42″ rear work platform. Locked from rotating, it can be moved up or down 12″ in column housing, giving 54″ maximum to 6″ minimum from spindle to work surface, without loss of drill location. It moves vertically by turning a switch that actuates column power elevation. Holes up to 22″ can be drilled without makeshift methods. The direct gear drive provides 16 spindle speeds in 4 optional ranges from 34 to 1640 rpm. Write the maker, or circle Inform-A-Gram No. P13.



BUY U.S. SAVINGS BONDS TODAY!

NEW ROTOR Airiter

saves time on all marking jobs

This new Rotor marker has been proven in scores of shops on parts and tools of all sizes...materials of all kinds. Users report it outperforms other air markers and other marking methods in ease and speed. Its fine control, with throttle located *on the tool*, adjusts its speed and depth of mark easily to suit every job. Short-stroke carbide stylus makes up to 12,000 blows per minute. Will not stall while writing.

Try it in your shop and see how it writes circles around other methods! Write for Bulletin AR-2. *The Rotor Tool Company, 26332 Lakeland Blvd., Cleveland 32, Ohio. Subsidiary of The Cooper-Bessemer Corporation.*

ROTOR TOOLS

CIRCLE INFORM-A-GRAM KEY NO. 971

SOPKO Grinding Wheel ADAPTERS

TOOLROOM ACCESSORIES

FREE Catalog

- For Use on All Popular Surface Tool and Cutter Grinders
- Precision-made, Hardened & Ground with Heat Treated Nuts
- Complete Line—4 New Models of Adapters Available
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SOPKO ADAPTERS Save Time and Money

Write for CATALOG and PRICES

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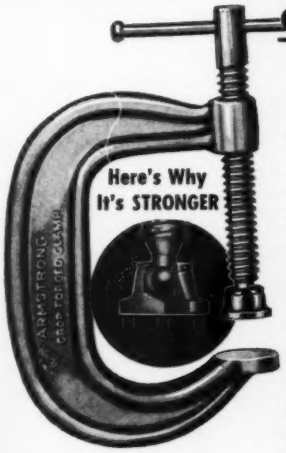
CIRCLE INFORM-A-GRAM KEY NO. 973

New ARMSTRONG Swivel Pad can't come off



NOW ARMSTRONG deep throat "C" Clamps have the new (Pat. apd. for) ARMSTRONG Ball-joint Swivel Pad. This "C" Clamp pad, developed by ARMSTRONG Engineers, is tougher than any on the market. Rigorous testing in our own plant first proved this fact, and field tests in factories throughout the country have confirmed our own test results.

The lip of the opening in the ARMSTRONG Ball-joint Swivel Pad is undercut so that when the ball of the screw is inserted, and the lip is permanently forced down, a solid steel wall is formed, inside the pad cavity, completely encircling the ball.

This wall of steel makes it impossible for the pad to come off the screw during normal use. In fact, our tests have proved that it is virtually impossible to intentionally knock the pad off with a hammer—yet the pad is free to swivel through an arc of approximately 40°.

Call your ARMSTRONG Distributor

Your ARMSTRONG Distributor can offer delivery from stock on this "400-Series" deep throat, drop-forged "C" Clamp with the new Ball-joint Swivel Pad. He also carries in stock the other styles of clamps in the ARMSTRONG Line—the broadest line of drop forged "C" Clamps.

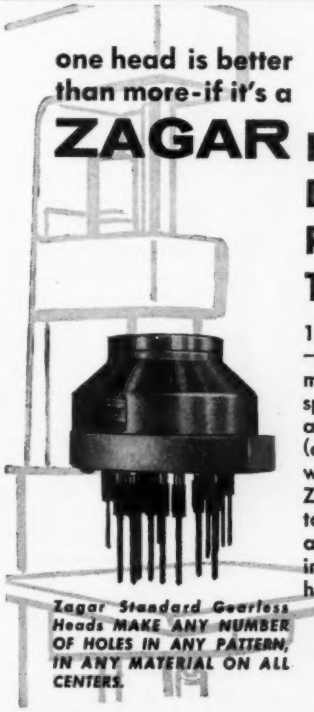
ARMSTRONG BROS. TOOL CO. 5220 W. Armstrong Ave Chicago 46, Illinois

SEE US AT BOOTH 3906 ASTME SHOW, NEW YORK COLISEUM

CIRCLE INFORM-A-GRAM KEY NO. 972

one head is better than more-if it's a

ZAGAR Head for Drilling, Reaming and Tapping



1 to 1000 holes in one pass—as close as twice drill diameter. Costs decrease as spindles are added. *And,* a variety of hole patterns (or parts) can be produced with *one fixed center head.* Zagar units are adaptable to standard drill presses or are built as a complete installation. Send in your hole problem to Zagar.

Zagar Standard Gearless Heads MAKE ANY NUMBER OF HOLES IN ANY PATTERN, IN ANY MATERIAL ON ALL CENTERS.

Write for Manual "T-4" for engineering data.

Zagar INCORPORATED 23894 LAKELAND BLVD. • CLEVELAND 23, OHIO

USE MORE SPINDLES TO DO MORE WORK

CIRCLE INFORM-A-GRAM KEY NO. 974

ROYAL GRIP-LOCK CHUCK JAWS
ENGINEERED and BUILT to give your production
THE GRIP OF PRECISION

ENGINEERED
Jaws made to American Standards, engineered and built for accurate holding and protection of workpiece.

INCREASE PRODUCTION
Made to hold work in lathes, turret lathes, multiple spindle machines, millers, chuckers. Increases production, accuracy, profits.

PERSONALIZED SERVICE
Royal people are interested in your needs and qualified to offer technical help; available to meet you personally.

ALSO MANUFACTURERS OF STANDARD SOFT BLANK JAWS / ASK FOR FACT-FILE BULLETIN

R CHUCK-JAWS and HOLDING DEVICES
ROYAL MACHINE & TOOL CORP.
Dept. TP • 31 Deming Road • Tel. YA 8-3544
BERLIN • CONNECTICUT

CIRCLE INFORM-A-GRAM KEY NO. 981

DUSTKOP "520"
designed to collect dust from single machines
portable—easily installed

DUSTKOP STOPS DUST

Self-contained Dustkop models, like the "520," are practical and effective in collecting dust from single machines. They're designed specifically for service with surface grinders, tool and cutter grinders, offhand grinders, buffers and other small wheel equipment. These units are also easy to install — are actually portable — and very economical to operate.

Write for illustrated literature
46 models to choose from!

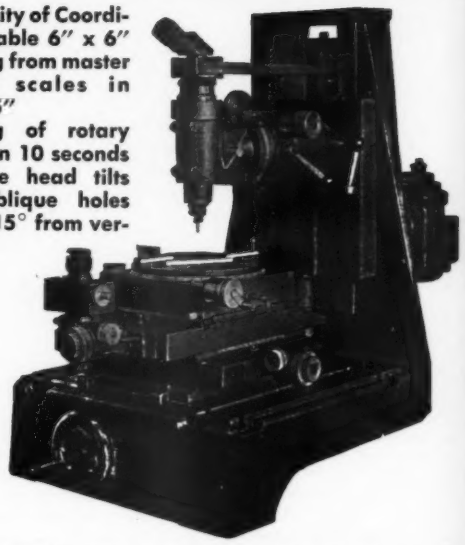
NEW DUSTKOP AUTO SHAKER shakes filters AUTOMATICALLY

AGET manufacturing company
1394 E. Church Street, Adrian, Michigan
ask for details

CIRCLE INFORM-A-GRAM KEY NO. 982

Leitz OPTICAL JIG BORER

- Capacity of Coordinate table 6" x 6"
- Setting from master glass scales in .00005"
- Setting of rotary table in 10 seconds
- Spindle head tilts for oblique holes up to 15° from vertical



REQUEST NEW 8-PAGE CATALOG 82-4T

OPTO-METRIC TOOLS, INC.
137-TP VARICK STREET, NEW YORK 13, N.Y.

CIRCLE INFORM-A-GRAM KEY NO. 983

Dahlstrom TAP GUIDE
$89.50
F. O. B. Factory
Taps By Hand with Drill Press EASE and ACCURACY

Just spot the hole and turn the handle for fast, easy custom tapping. A ruggedly built Dahlstrom Tap Guide taps straight every time—reduces tap breakage. Saves time lost digging out broken taps. Fastens to bench or carries to job . . . Taps big jobs through base . . . Spindle can tap on lathe or be a tap extension. Comes with 9 adaptors 8-32 to ¾" (taps not furnished) . . . 7½" throat . . . 8" x 11¼" table . . . wt. 32 lbs. *ORDER NOW—SAVE TAPS and TIME!*

Ask for bulletin on the Dahlstrom line of bench tools.

Branch MANUFACTURING COMPANY
16 Olson Drive, North Branch, Minn.

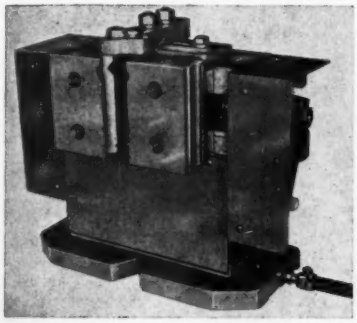
CIRCLE INFORM-A-GRAM KEY NO. 984

Product News

Repeated Clamping

A new industrial plier is capable of predetermined clamping up to 1200 lbs, regardless of thickness of work. This load indicating feature is available in four models of the plier, as well as the "C" clamp series. A "load indicating washer," is the heart of the tool, and for use the adjusting spindle is set for the desired clamping force by trial clamping. After determination of the right holding force, the self-locking nut on the plier anvil is adjusted and the load indicating washer moves smoothly with the plier. For more information write Lapeer Mfg. Co., 1150 Baltimore W., Detroit 2, Mich., or circle Inform-A-Gram No. P14.

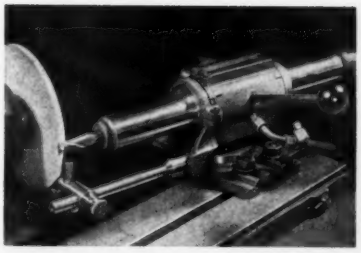
Holds Work Pneumatically



Sure Center air vise consists of two movable gibbed master jaws and works from levers connected to an accurate cam. It will repeatedly center a piece part within 0.0015 or better. Operating on shop air, the unit is ideal for drilling, tapping, milling, counterboring and reaming. It also works on screw machine secondary operation, on round, hex or square stock, standard or odd shaped, smooth or rough castings. Sure Center is credited with holding force of more than 5500 lbs at 100 lbs line pressure with a maximum jaw opening of 2½". Write Heuser Mfg. Co., 1638 N. Paulina St., Chicago 22, Ill., or Inform-A-Gram No. P15.

Floating on Air

Honing of tools as small as 1/32" and up to 1¼" shank capacity is feasible with Air-Flow, a new end-mill and milling cutter sharpening fixture by Harig Mfg. Corp., 5757 W. Howard St., Chicago 31, Ill. The spindle that floats on a cushion of air is sensitive and jerk-free. The minute (0.00015) film of air is said to discourage entry of grinding dust. Milling cutter sharpening range is through 6" dia, and any style such as side mills,



stagger teeth, etc. may be sharpened. For more complete specifications write the manufacturer, or circle Inform-A-Gram No. P16.

PRECISION Digest 1

PRECISION WELDER AND FLEXOPRESS CORPORATION • 3526 Ibsen Ave., Cincinnati 9, Ohio

2 Million Parts Per Die Grind

ESSEX JUNCTION, VT.—Every so often a Flexopress fails to live up to expectations.

Instead of increasing die life normally, it increases it to 2 million parts between grinds.

Instead of cutting cost per part a reasonable amount, it cuts it by 50 per cent.

Instead of assuming its typical share of downtime, it logs only two days off for maintenance in four years.

This machine does not wear a halo. It is a typical straight side, 50-ton Flexopress doing what it is supposed to do—blanking and forming critical steel parts for relays in the International Business Machines Corporation plant at Essex Junction, Vt.

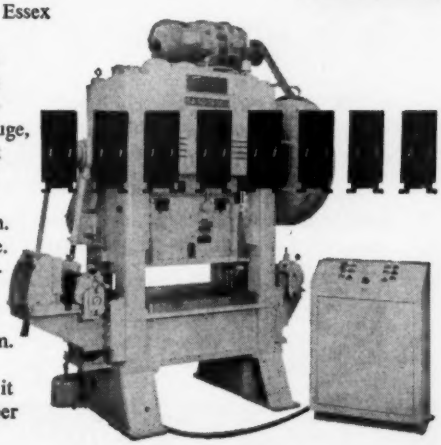
As the picture shows, the part is a relay armature insert with sharp corners and a couple of raised chevrons. Material: C-1010 steel. 22-gauge, cold rolled in coils. Tolerances: flat within .002"; corner burrs not over .002"; free from twist. Quantity: 200,000 per order, 2 orders per run. Production rate: 325 parts per minute.

Such speed of production ordinarily leads to severe scrap buildup, short die life, high costs, and sets the press to dancing 'round the room. But this is no ordinary press.

The solid carbide dies used with it turn out more than 2 million parts per sharpening (compared to 50,000 parts per sharpening for steel dies). Moreover, die sharpening time is now 1/40 of former time.

The biggest difference between the Precision Flexopress and any other press is its preloaded ball-bearing slides. They contain the ram without clearance, and therefore without slop. Preload on the slides exceeds the angular thrust load imposed by the action of the connecting rod and crank, so that the ram can move only in the plane of the slides—up and down but never sideways.

PRECISION

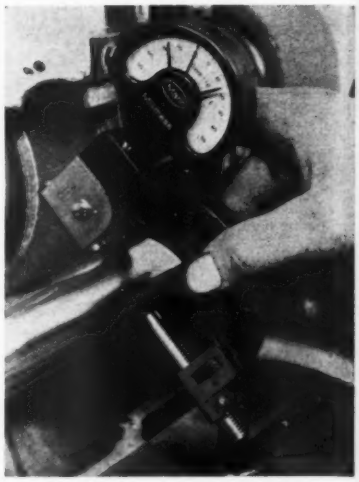


CIRCLE INFORM-A-GRAM KEY NO. 99

Product News

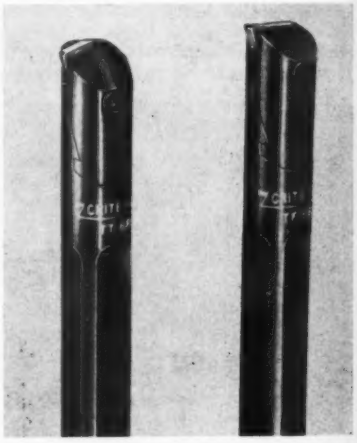
Gaging Without Guessing

An adjustable snap gage with indicator reading in 50 millionths or finer is said to leave nothing to operator feel, or guesswork. Wide tungsten carbide tipped measuring anvils with predetermined adjustable measuring pressure locate themselves at right angles to the axis of material. The moving spindles with extra long guideway travels free and assures parallelism of the measuring faces at all settings. One gaging head can be interchanged in the size range from 0 to 8". Gaging heads reading directly in 50 millionths, 20 millionths and ½ thousandths are available. Illustrated folder with specifications is offered by Mahr Gage Co., 274 Lafayette St., N.Y., N.Y., or through Inform-A-Gram No. P17.



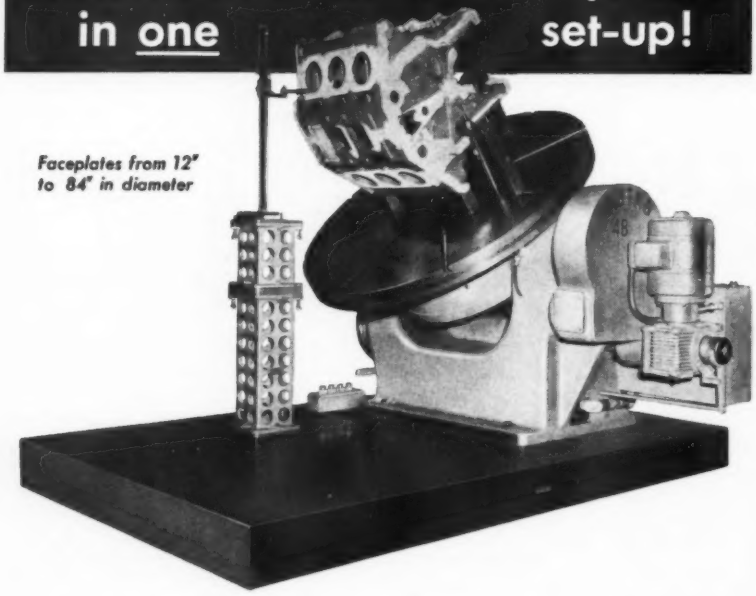
Throw-away Tip Boring Bars

A new throw-away tip boring bar makes news at Criterion Machine Works, West 16th St., Costa Mesa, Calif. Available in two styles, each in six sizes, the tools range in hole entry size from ¾ to 2", in lengths from 7 to 13".



Shorter lengths are planned for use in Criterion boring heads. Designed for bottoming and facing, the TF tool uses precision ground triangular tip. For through and general boring, TT tools with precision ground square tips do the job. General purpose grade carbide is furnished with each bar, and additional inserts can be readily purchased. A unique feature in the throw-away tip bars is the locking principle which distributes stress over a large area. It insures maximum rigidity and prevents lower half of the bar from receiving the full down thrust. Write Criterion, or check Inform-A-Gram No. P18.

Dimensional check on 7 planes in one set-up!



Faceplates from 12" to 84" in diameter

Up to 50% savings in time and manpower

Every angle, diameter, line, critical surface on 7 V-block planes is completely checked without disturbing the initial set-up. Previously a two-man operation . . . now, with motor-powered, push-button tilting and rotation offered by the ROTAB precision positioning table, one man quickly, accurately runs the entire inspection in about half the time. This is how ROTAB is paying off for a major diesel engine manufacturer . . . ROTAB will pay off for you, too. Write for details.

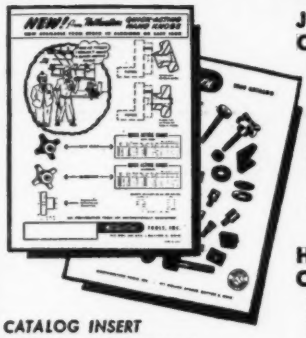
MP MACHINE PRODUCTS CORPORATION
6771 E. McNICHOLS ROAD • DETROIT 12, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 100

NEW

ALUMINUM CAST IRON

QUICK-ACTING HAND KNOBS



JIG AND FIXTURE COMPONENTS

- LATCH BOLTS
- CAST IRON HAND KNOBS
- ALUMINUM HAND KNOBS
- QUARTER TURN SCREWS
- SHOULDER SCREWS
- JIG FEET (3 TYPES)
- SPHERICAL WASHERS
- FIXTURE KEYS
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HOLD DOWN AND CLAMPING TOOLS

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IMMEDIATE DELIVERY ON

SOFT BLANK TOP JAWS

SAVE OVER 50%

Soft-Blank Top Jaws are made to American Standards and may be used on any chuck having master jaws that are made to these specifications.

Both Medium and Heavy Duty styles are carried in stock and are available for immediate delivery from 1020 steel.

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HURON MACHINE PRODUCTS INC
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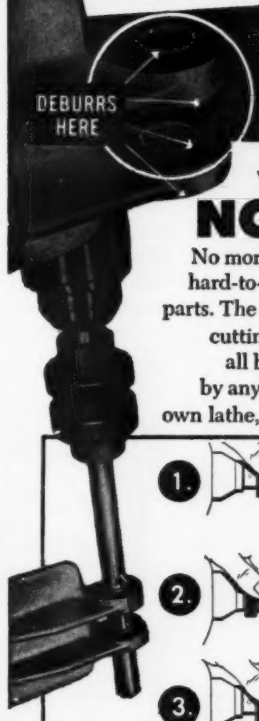
CIRCLE INFORM-A-GRAM KEY NO. 1012

How to... DEBURR THESE INACCESSIBLE HOLE FACES BY MACHINE OPERATION

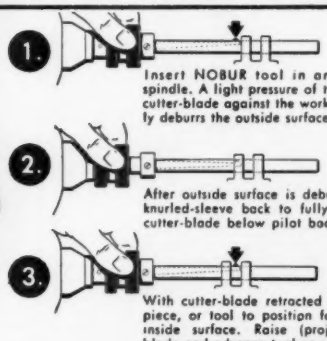


★ faster
★ better
★ easier

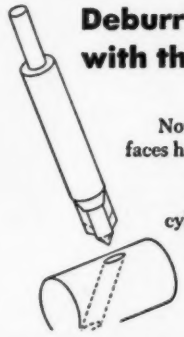
with the amazing

NOBUR TOOL

No more hand-finishing methods for those hard-to-get-at inner surfaces on multi-wall parts. The NOBUR Tool with its double edge cutting blade does the job in seconds . . . all by *machine operation*. Can be used by anyone, with complete safety, on your own lathe, drill press, etc. Simple to operate.



1. Insert NOBUR tool in any machine spindle. A light pressure of the revolving cutter-blade against the workpiece quickly deburrs the outside surface.
2. After outside surface is deburred, slide, knurled-sleeve back to fully retract the cutter-blade below pilot body diameter.
3. With cutter-blade retracted move workpiece, or tool to position for deburring inside surface. Raise (project) cutter-blade and advance tool or work piece to deburr first one surface then the other.



Deburring Elliptical Holes with the *NEW!* ELLIPTI-BURR TOOL

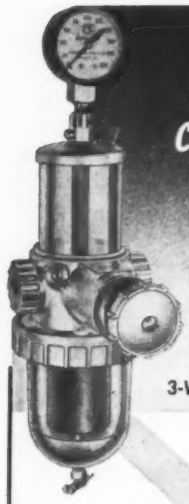
Now . . . deburr openly accessible hole faces having an irregular surface like those developed when holes are drilled angularly or when drilled through cylindrical bodies. This revolutionary tool is self-piloting with a two-lipped cutter that automatically follows the hole surface geometry. Write for full data.

Write for FREE Folder

Send for all the details on Nobur Tool Products — the key to *lower* costs, *higher* production and *improved* quality on your deburring operations. WRITE TODAY!

NO/BUR TOOLS **NOBUR** MANUFACTURING CO.
6860 Farmdale Ave., No. Hollywood, California

CIRCLE INFORM-A-GRAM KEY NO. 1013



CONTROLLED COMPRESSED AIR

PSC

3-WAY AIR CONTROL

REGULATOR
FILTER
LUBRICATOR

This **compact package unit** removes dirt, grit scale and moisture—prevents rusting and scoring—balances air surges—serves as shut-off valve.

Saves many dollars and valuable time by preventing unnecessary maintenance—down-time—and replacement of costly air tools and equipment.

REGULATOR

Accurate
Dependable
Positive Seating

Large orifice and piston maintains accurate pressure adjustment. Automatic bleed-off saves valuable set-up time. Balances pressure surges. Proper pressure assures peak performance.

FILTER

Dual Filtering
Cyclonic Action

Fine filtering removes dirt scale and condensate. Prevents damage due to dirty air. Permits air tools to operate at top efficiency. Less down-time, more production-time.

LUBRICATOR

Automatic Won't Flood

Automatic foglike oil mist protects and lengthens service life of air tools and equipment. Prevents costly repairs and replacement of air tools due to scoring and rusting. Assures long trouble-free service.

REGULATOR-FILTER

Accurately regulated, clean, moisture-free air assures a smoother, more efficient tool operation. Maintain peak production. Cut production costs.

Ask for Bulletin 80, listing and describing our complete line of Air Controls.

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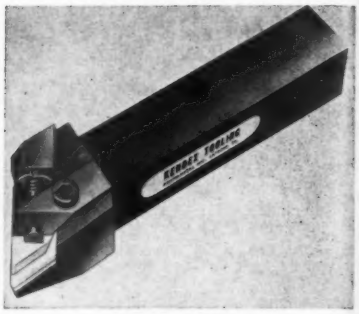
CIRCLE INFORM-A-GRAM KEY NO. 1021

Product News

Tight Profiling

A new profiling tool by Kennametal, Inc., Latrobe, Pa., double locks inserts in the tool recess. The insert is held against back walls of the tool recess by a cam pin through the insert, and in its seat by a top clamp. Also new to this type of tool is easy dial adjustment with the company's Dial-A-Breaker. For easy changing, indexing or inverting of the insert, the chip breaker is raised by a plunger when the clamp is released. The diamond shaped inserts have a 55° nose angle and are set in the holder at a 5° negative side and back rake to provide 4 cutting points. Three styles of holders to meet most machine tool requirements are available from stock. For more information on holders, inserts, chip breakers, shims etc., write the manufacturer, or circle Inform-A-Gram No. P19.



Selecting Screws

With the flick of a dial, head, thread and washer identification problems are said to be eliminated. Screw Descriptor consists of two dials and shows pictures and correct names. By aligning the proper thread on the inner dial with the proper head on the outer dial the prospective purchaser makes his choice. Fitting washers are supplied on the inner dial as well. Offered free, the Screw Descriptor is available from Active Screw & Mfg. Co., 4250 N. Pulaski Rd., Chicago 41, Ill., or by circling Inform-A-Gram No. P20.

for as little as $22.00 COMPLETE IN U.S.A

Get This Production Boosting
"TRICO-MIST"
COOLANT SYSTEM

Increase Production and Tool Life As Much As 500%!

For drilling, tapping, milling, sawing, grinding, etc. Removes heat from cutting edges of tools and work. Feeds can be increased considerably, finer finishes and accuracy are obtained. TRICO-MIST absorbs heat, thereby quenching it faster than flood coolants which only transfer it. Chips slide freely up the tool face and are blown away automatically. Simple needle valve controls size and volume of mist spray. Attaches to shop air line. Available with one and five gallon containers — single or multiple outlets — single or dual valve control.

SEND FOR BUL. No. 37

TRICO FUSE MFG. CO.
MILWAUKEE WIS U S A

CIRCLE INFORM-A-GRAM KEY NO. 1022

CAM milling / JIG boring

A SPECIALIZED CAM MILLING SERVICE, JIG BORING, SPOT WELDING, CONTRACT PRODUCTION

EXPERIMENTAL DEVELOPMENT

CAM CALCULATING SERVICE

Write for catalog 55-C

EISLER ENGINEERING CO., INC.
Chas. Eisler Jr. President
732 So. 13th St. Newark 3, N. J.

CIRCLE INFORM-A-GRAM KEY NO. 1023

Product News

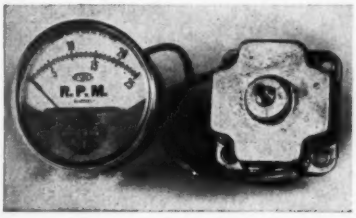
A New Star

Tool and die shops, toolrooms and low production operations set the stage for a new star. Profile-grinder Star 3 is said to grind and polish contour and irregular shapes rapidly, economically and accurately. Mounted on a vertical reciprocating spindle, the grinding wheel is in the center of a counterweighted 18″ dia round work table. To grind a part contour, the easily accessible, slide-mounted table is unlocked, raised with a capstan handwheel and locked to bring part into correct vertical contact with the reciprocating

grinding wheel. The grinder has wheel speed of 4500, 6500, and 10,150 rpm. Write the Star Cutter Co., P.O. Box 376, Farmington, Mich., or Inform-A-Gram No. P21.

Reads Anywhere

There's no need to guess the speed of manufacturing operations according to Westberg Mfg. Co., 144 S. Coombs St., Napa, Calif. The company has developed an industrial tachometer that's said to indicate speed of shafts, belts, and electrical frequency. The units are easy to install and are not affected



by overspeeding, vibration, temperature, length of leads, direction of rotation, magnetic fields or line voltage variation of 100-140 volts. Other features are no gears or drive cables, low operating torque 1/10 ″/oz. and 2% accuracy, uniform scale divisions. Write the maker, or circle P22.

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has been done with the SCLEROSCOPE
Since 1907
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THE SHORE INSTRUMENT & MFG. CO., Inc.
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Jamaica 35, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 1031

INSTALL THE
NEW
TOOL SETTING GAGE
On YOUR Jig Borer

Here is the new Euclid Tool Setting Gage in action! Accuracy with ease of operation make it outstanding in its field!

Take a finish cut on the first pass by setting the tool with a Euclid Gage. Eliminate the old trial-and-error method and —

- SAVE TIME
- ELIMINATE SCRAP
- ELIMINATE "SHOULDERS" IN THE MOUTH OF THE BORE
- ELIMINATE NERVOUS STRAIN ON OPERATOR
- INCREASE PRODUCTION, AND
- OBTAIN A BORE OF MICROMETRIC ACCURACY **EVERY TIME**

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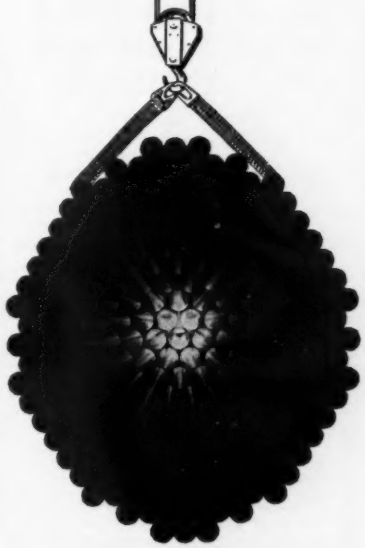
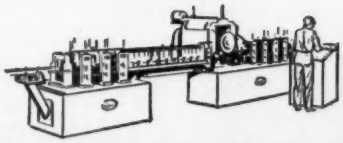
18421 Buffalo
Cleveland 23, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 1032

If you need lots of pipe or tube

...YODER makes the mills that make it!





For complete information on YODER Pipe or Tube Mills...write for the fully illustrated, 88 page YODER Tube Mill Book...it is yours for the asking.

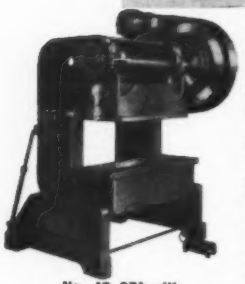
THE YODER COMPANY
5501 Walworth Avenue • Cleveland 2, Ohio
1910 FIFTY YEARS 1960

ENGINEERING YODER MANUFACTURING
PIPE AND TUBE MILLS
(ferrous or non-ferrous)

CIRCLE INFORM-A-GRAM KEY NO. 1033

High-Output with ROUSSELLE

DOUBLE-CRANK PRESSES



No. 48 OBI with "Econo-Air" clutch.

SPEED UP PRODUCTION with these versatile 40-ton presses. Large bed and ram areas make them ideally suited to handle wide rolls or sheets . . . do multiple punching, steel-rule die work and other high output operations. For rapid, shockless starting and stopping, presses can be equipped with electrically controlled "Econo-Air" friction clutch . . . Ask for new catalog.

STRAIGHT SIDE – Die space up to 24 in.; bed space up to 6 ft. between uprights.

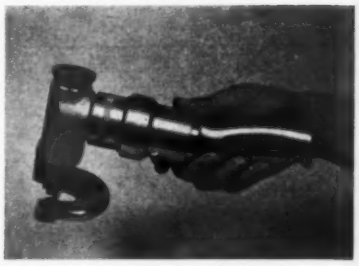
Choice of over 30 models and types in 5 to 60-ton sizes

SERVICE MACHINE COMPANY
Mfrs. of Rousselle Presses
2310 WEST 78TH STREET • CHICAGO 20, ILLINOIS

Rousselle Presses are sold exclusively through Leading Machinery Dealers.

CIRCLE INFORM-A-GRAM KEY NO. 1041

Intricate Cutting



New compact pneumatic shears have joined the family of Desoutter air tools. Weighing only 2½ lbs, the shears cut steel at 6 fpm with a capacity of 0.080. For cutting stainless steel, the easily replaceable blades are available in stellite. The tool is powered by a compact air motor through planetary gearing, and is designed especially for intricate cutting work. Write Newage Industries, Inc., 222 York Rd., Jenkintown, Pa., or circle Inform-A-Gram No. P23.

MINIATURE
DRILL BUSHINGS

Hole Sizes—No. 80 to 3/32"
O.D. 3/32" to 13/64"
Lengths ¼" to 3"
.0002 Tolerance on I.D.
O.D., and Concentricity
Specials to your specifications
WRITE FOR CATALOG

PREBCO BUSHING CO.
14714 East Arrow Hwy., Baldwin Park, Cal.

CIRCLE INFORM-A-GRAM KEY NO. 1042

HOLES

ECONOMICAL
FAST DRILLING
IN DEEP HOLES

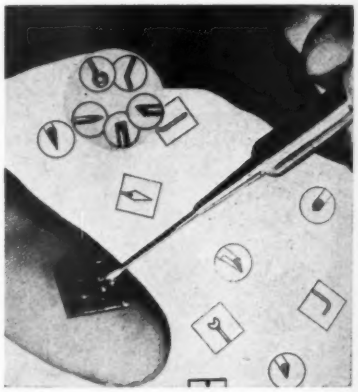
Clark "SPADE DRILL"
P. O. BOX 990 BEVERLY HILLS, CALIF.

CIRCLE INFORM-A-GRAM KEY NO. 1043

Product News

Microminiatures

Balance and precision hand manipulation is provided by new microminiature tools developed by Circon Component Corp., Santa Barbara Municipal Airport, Goleta, Calif. The tools embody active elements from 0.001 to 0.01 and take the place of mechanics' tools and manicure tweezers for ultra small jobs. Keyed to solid state electronics, the microtools are compatible in size with advanced microcircuitry and components. The new line embraces 67 different tools all interchangeable with metal handles. Cutting edges, points and working surfaces are precision forged, machined, ground



or honed, and the tip area behind the working element is 24 carat gold plated and shot-burnished against corrosion. Inform-A-Gram No. P24.

TRIAL SAMPLE!

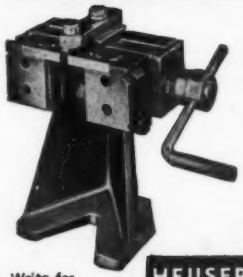
SPECIAL LUBRICANT
EASES WORKING STAINLESS
AND TOUGH METALS

New lubricant eases stamping and machining operations on the toughest metalworking jobs—takes the problems out of hard-to-work metals such as stainless, high carbon, high chrome, cast iron, monel, etc. Scientifically developed ANCHORLUBE now used extensively in a wide range of applications—drilling, tapping, spot facing, counter-boring, milling, fly-cutting, seat forming, engraving, broaching, drawing, piercing, punching, hole extruding, etc. Application by swab, spray, roller or brush. Send today for free trial sample and see for yourself how easy you can work the job with ANCHORLUBE.

ANCHOR CHEMICAL COMPANY
Dept. TP-4 • 10721 Briggs Rd. • Cleveland 11, O.

CIRCLE INFORM-A-GRAM KEY NO. 1044

SPEED UP DRILLING & TAPPING JOBS!



JOHN'S DRILL JIG

For cross or end drilling round, hexagon, or square stock or standard or odd-shaped rough castings from ⅛" to 8" O.D., the self-centering "John's Drill Jig" will cut tooling and production costs to minimum for 10 to 100,000 pieces.

Standard removable slip fit bushings and holders available to drill center or mean off-center. The self-centering action will hold within .0015" or better regardless of jig wear or piece part O.D. variation. Jigs available in three sizes 6", 8", 14"; jaw openings 2", 3¼", 7½".

Write for complete information

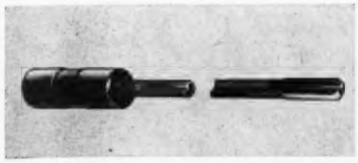
HEUSER MANUFACTURING CO.
1642 N. Paulina St., Chicago 22, Illinois

CIRCLE INFORM-A-GRAM KEY NO. 1045

Product News

Gun Drills Ground to Order

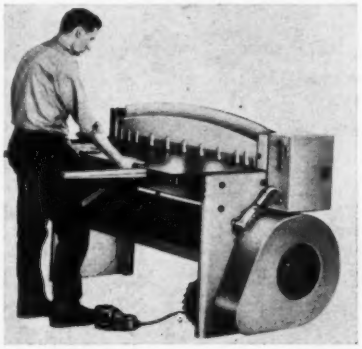
Carbide gun drills are stocked semi-finished and ground to order at Wetmore Tool & Engineering Co., 5320 E. Washington Blvd., Los Angeles 22, Calif. Shipment within 48 hrs is promised. Standard stocked sizes range from 0.180 to 1.312 dia in lengths up to 36".



Single flute construction with wear pads insure negligible runout while burnishing the hole to a high finish. A hole is provided for high pressure coolant and chip removal. Also offered is an inexpensive sharpening fixture that's said to give factory regrind quality results, even in the hands of inexperienced operators. More from the manufacturer, or through Inform-A-Gram No. P25.

Cuts Deep and Fast

Model 48 Di-Acro power shear bites into ferrous and non-ferrous material up to 50" wide and as heavy as 16 ga mild steel at 16 strokes/min. This high speed makes the machine adaptable to conveyor and runout lines, according to Di-Acro Corp., 626 Eighth Ave., Lake City, Minn. A self-adjusting electric clutch, built into the flywheel and connected to the motor via triple v-belt drive, allows instantaneous cycling. Shear blades are angled to bring only the blade edge in contact with material, and shearing is to die-accuracy. It's equipped with motor, all electrical equipment, automatic hold down bar, micrometer operated back gage, front gage bar and bracket, side squaring gages, reversible protractor gage and a set of four-edged blades and movable foot trip control. Inform-A-Gram No. P26.



Every Shop Should Own One

No distortion — even on ⅛" stock!
MODEL "C"

KNURLMASTER Hand Knurler

For small production runs on ⅛" to 1" stock. Exclusive screw design gives perfect knurl pattern. Furnished with 3 hardened straight or diamond pattern knurls of standard ½" dia. Forged steel frame is self-centering. Write for illustrated folder.

ROCKWIN MANUFACTURING CO.

80A MAGNOLIA AVE., WESTBURY, L.I., N.Y.
CIRCLE INFORM-A-GRAM KEY NO. 1052

WHY WAIT? IMMEDIATE DELIVERY!

LARGEST STOCK OF
SPECIAL RH & LH Taps-Dies & Thread Plug Gages

Also in Stock:
- RING GAGES • ACME & METRIC TAPS & DIES
- SPECIAL REAMERS
- EX. LONG DRILLS

Write Today for WALL CHART Special Taps Also Made to Your Print Specifications

Quotations on Request

FIELD TOOL SUPPLY CO.
Industrial Cutting Tools
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All Phones: Financial 6-1195

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DRILL THESE HOLES
BY A QUICK, EASY, INEXPENSIVE METHOD
Your business letterhead will bring literature.
WATTS BROS. TOOL WORKS
Wilmerding, Penna.

CIRCLE INFORM-A-GRAM KEY NO. 1054

LIFTING DEVICES

for
FAST • SAFE • BETTER
Material Handling
of
• SHEETS
• COILS • BOXES
• MOLDS
• DRUMS • PALLETS
400 MODELS
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CIRCLE INFORM-A-GRAM KEY NO. 1055

SPELLMACO SPOTTERS

A matched set of transfer punches for toolmakers, machinists and tool cribs.

Used for transferring location of threaded, drilled and reamed holes, slugs, blanks, etc.

Precision made of finest tool steel carefully heat treated and tempered for long life. .0025 undersize to facilitate use—black oxide finish.

Set No. 3-17: 28 punches with indexed stand — sizes 3/32" to ½" by 1/64" plus handy 17/32" size—length 4⅞". PRICE only $19.40

Single sizes available.

R. L. SPELLMAN CO. • Urbana, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 1051

Fortune

TUMBLING MEDIA for Deburring and Finishing

Preforms in over 300 shapes, sizes and bonds for all barrel and vibratory operations.
- Finest bonding materials
- No "roll-over" of burrs
- Minimum media fracture
- Maximum production

Free lab service reports proper media for your parts.
Write today for our Tumbling Media File.

Fortune Industries, Inc.
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Phone GR 9-3621

CIRCLE INFORM-A-GRAM KEY NO. 1056

Tomco INC.
HAND WHEELS
Straight Type Offset Type
SPECIALS
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• MACHINE HANDLES
• HANDLES
• BALL HANDLES
• LEVERS
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GRADUATED DIALS
SPECIFY TOMCO FOR DEPENDABILITY
A Complete line of high grade hand knobs, levers, handles, hand wheels, graduated dials is available for immediate shipment from stock of standard items. Specialty items made to your specifications.
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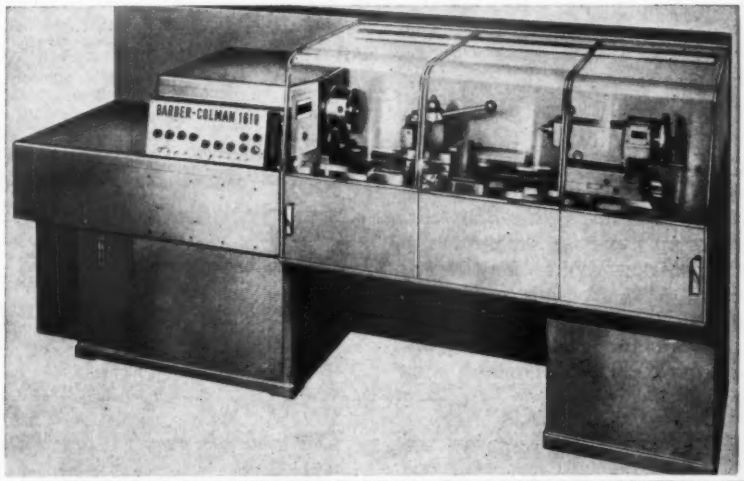
CIRCLE INFORM-A-GRAM KEY NO. 1061

Product News

Built-In Numerical Control

A new lathe features numerical control without complex electronic equipment. An integral tape system actuates mechanical functions directly from digital data. Along with stopping, starting, positioning, feed adjusting and changing, the discrete data system also coordinates carriage and cross slide for simple radii and taper turning. The Tape-r-guide, with its simple 8-channel binary code tape in headstock, turns tapers without "hunting," cuts chamfers and does parting and boring without special tools. Model 1610, with swing capacity of 16 x 20", and infinitely variable spindle speeds to 1200 rpm, is built by Barber-Colman Co., Rockford, Ill. More data from them, or through Inform-A-Gram No. P27.



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4 DISTINCTIVE STYLES IN CARBIDE & HSS
SIZES FROM 1/16" UPWARD
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EDgewood 3-1382
BORING
FACING
THREADING
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DETACHABLE HEAD TYPE
SOLID SHANK TYPE
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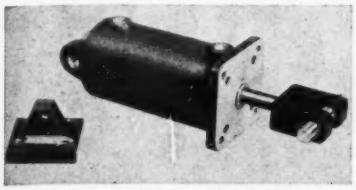
Manufacturers of over 85% of the torque wrenches used in industry
CIRCLE INFORM-A-GRAM KEY NO. 1063

Product News

More Flair, Less Air

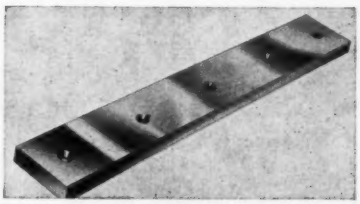
The newest member of the "Air Clamp" family of Fluid Dynamics, Div., Mead Specialties Co., 4114 N. Knox Ave., Chicago, Ill., is said to use less air volume than conventional double-acting cylinders of the same size. Depending upon application, the single-acting unit can also work as a double-acting cylinder. Simplified return action



through a conical spring allows use of a 3-way instead of a 4-way valve, and results in simplified piping. With pressure tightening seals, the unit also features an Oilite road cartridge and full floating double-lip piston cup. It comes in 2¼, 3, 4 and 5″ bore sizes with 1, 2, or 3″ strokes. More specifics from the maker, or through Inform-A-Gram No. P28.

Hot or Cold Cuts

Three different grades of steel shear blades for a variety of cutting jobs have been introduced by Ohio Knife Co., Cincinnati 23, Ohio. They recommend OK Battle

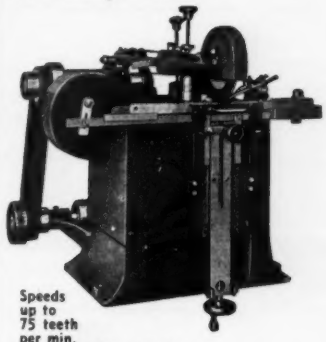


Axe grade high carbon, hi-chrome steel for shearing mild steels and metals up to 0.25″ thick and OK #4 HSS for efficient shearing of cold reduced sheets or strip in mild and silicon steel from 0.005 to 0.032″. OK DuraChrome shears of hi-carbon, hi-chrome, shock resistant steel are designed for medium duty cutting, shearing hot or cold plate up to 0.25″ thick and for short runs and extra heavy plate up to 0.625″. Other special steels are available for specific applications. Write the company, or circle Inform-A-Gram No. P29.

SAVED SAWS SAVE

Money you can put in your pocket!

Sharpening a gross of hack saws just 6 times will return the price of this Model EC Combination HACK, BAND and CIRCULAR Saw Sharpener.



Speeds up to 75 teeth per min.
As fine as 32 per inch.

Also Mfgrs of
FLUTE MILLERS & GRINDERS
Write for Complete Details.

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MANUFACTURING CO.
3809 Ridge Road, Cleveland 9, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 1071

Spline "between-pins"

Shallow holes

Short thru holes

Blind holes

Spline root diameter

Spherical holes

Whether you need a precision gage for plain round holes . . . or "specials,"

THIS EXPANSION-PLUG GAGE IS WONDERFULLY ADAPTABLE

EXPANDING COMTORPLUG IS READILY ADAPTED TO YOUR SPECIAL NEEDS.

Here is the only gage that makes between-pins gaging of splines as simple and precise as gaging a plain round hole. By simple adaptations, it fits many special needs encountered in volume-precision programs. And for plain round holes from ⅛″ to 10″ diameter . . . at machine, in chuck, or at bench . . . it gives precise automatic 2-point gaging of all parts of a bore. It shows up exact amount of any front or back taper, ovality, barrel shape, bell mouth, etc. Applied by the thousands in aircraft, electronic, automotive, electrical, household appliance and other fast-moving programs, Comtorplug may be exactly suited to your needs. For details write . . .

COMTOR COMPANY, 82 FARWELL ST., WALTHAM 54, MASSACHUSETTS

For holes ⅛″ to 10″ diameter

REQUEST BULLETIN 50

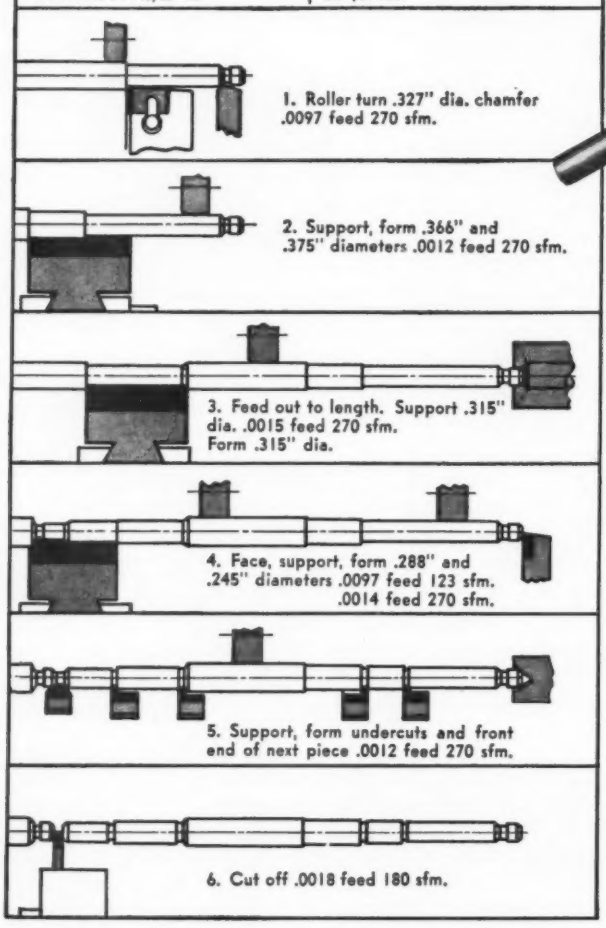
COMTORPLUG with interchangeable expansion plugs to gage simple or special holes to a fraction of .0001″.

CIRCLE INFORM-A-GRAM KEY NO. 1072

GREENLEE AIR-FEED AUTOMATICS BENEFIT "ELECTROLUX" FOUR WAYS . . .

MACHINE . . . 1"-6 Automatic Bar Machine Air-Feed — Feedout on index and in 3rd position during machine cycle.
TOOLING . . . Carbide Tipped
MATERIAL . . . 1137
STOCK SIZE . . . 13/32" rd.

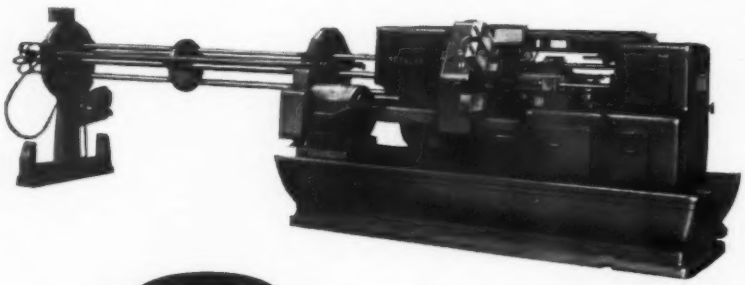
TOOL SLIDE STROKE . . 1-9/16" at .0097" feed.
SPINDLE SPEED . . . 2540 rpm 270 sfm.
MACHINE TIME . . . 5.8 seconds.
ESTIMATED GROSS PRODUCTION . . . 620 per hour


1. Roller turn .327" dia. chamfer .0097 feed 270 sfm.
2. Support, form .366" and .375" diameters .0012 feed 270 sfm.
3. Feed out to length. Support .315" dia. .0015 feed 270 sfm. Form .315" dia.
4. Face, support, form .288" and .245" diameters .0097 feed 123 sfm. .0014 feed 270 sfm.
5. Support, form undercuts and front end of next piece .0012 feed 270 sfm.
6. Cut off .0018 feed 180 sfm.

1. Eliminate stock pushers . . .
2. Eliminate scoring of stock . . .
3. Reduce downtime during set-up . . .
4. Provide extra length feed-out . . .

The part is a 6-7/8" long armature shaft used in the "Electrolux" vacuum cleaner. It demonstrates how effectively Greenlee Air-Feed Automatics and carbide tooling can team-up to increase production and reduce costs. The shaft is machined from 13/32" S.A.E. 1137 steel at a gross production rate of 620 pieces per hour. Recommended cutting speed for high speed tooling is 120 sfm. The rate was boosted to 270 sfm with carbide-tipped tooling. Sequence of operations is shown at the left.

Note how the stock is partially fed out on the index and to its full length in the third position. This provides for the most effective tooling arrangement. Greenlee Air-Feed Automatics permit greater job versatility and assure added profits. See your Greenlee representative or send us a print of your high-cost problem-part.



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TRANSFER MACHINES • SPECIAL MACHINES • AUTOMATIC BAR MACHINES • WOODWORKING MACHINES AND TOOLS • DIE CASTING MACHINES • TRIM PRESSES • HYDRAULIC AND HAND TOOLS

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7	21	38	72	87	761	953	1022	1054	1122	1181	
8	22	39	73	92	762	971	1023	1055	1123	1182	
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11	25	57	77	108	765	974	1033	1062	1133	1201	
13	26	58	78	109	851	981	1041	1063	1141	1202	
14	27	61	79	123	852	982	1042	1071	1142	1211	
15	28	64	80	125	853	983	1043	1072	1151	1212	

EDITORIAL ITEMS

C1	C11	C21	C31	C41	C51	C61	P1	P11	P21	P31	P41
C2	C12	C22	C32	C42	C52	C62	P2	P12	P22	P32	P42
C3	C13	C23	C33	C43	C53	C63	P3	P13	P23	P33	P43
C4	C14	C24	C34	C44	C54	C64	P4	P14	P24	P34	P44
C5	C15	C25	C35	C45	C55	D1	P5	P15	P25	P35	P45
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C7	C17	C27	C37	C47	C57	D3	P7	P17	P27	P37	
C8	C18	C28	C38	C48	C58	D4	P8	P18	P28	P38	
C9	C19	C29	C39	C49	C59	D5	P9	P19	P29	P39	
C10	C20	C30	C40	C50	C60	D6	P10	P20	P30	P40	

Which article in this issue interested you most?

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6	20	33	71	86	702	952	1021	1053	1121	1172	
7	21	38	72	87	761	953	1022	1054	1122	1181	
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13	26	58	78	109	851	981	1041	1063	1141	1202	
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EDITORIAL ITEMS

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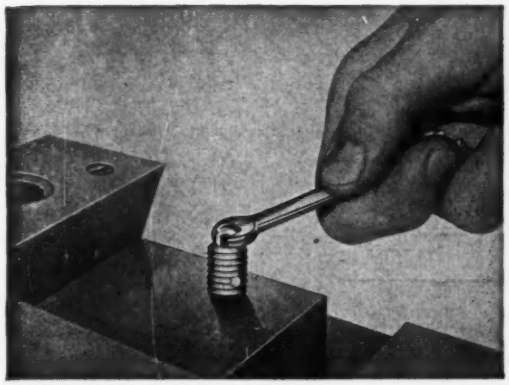
C2	C12	C22	C32	C42	C52	C62	P2	P12	P22	P32	P42
C3	C13	C23	C33	C43	C53	C63	P3	P13	P23	P33	P43
C4	C14	C24	C34	C44	C54	C64	P4	P14	P24	P34	P44
C5	C15	C25	C35	C45	C55	D1	P5	P15	P25	P35	P45
C6	C16	C26	C36	C46	C56	D2	P6	P16	P26	P36	
C7	C17	C27	C37	C47	C57	D3	P7	P17	P27	P37	
C8	C18	C28	C38	C48	C58	D4	P8	P18	P28	P38	
C9	C19	C29	C39	C49	C59	D5	P9	P19	P29	P39	
C10	C20	C30	C40	C50	C60	D6	P10	P20	P30	P40	

Which article in this issue interested you most?

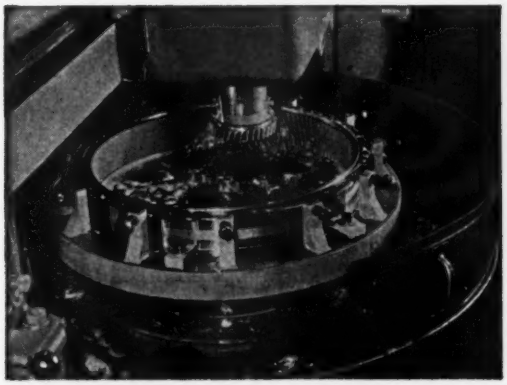
Practical Tooling Tips

No. 4 of a series

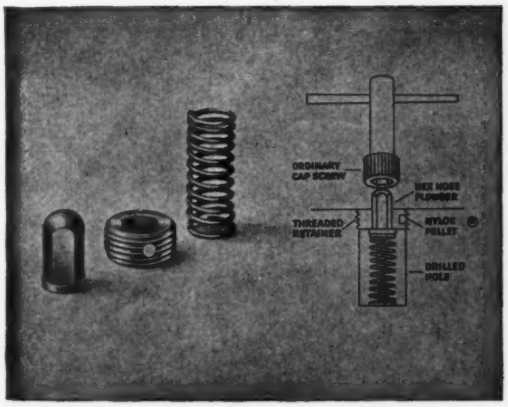
New uses are being found every day for Vlier Tooling Accessories. Perhaps the applications shown below will suggest ways you can profit by replacing costly, custom devices in jigs, dies and fixtures with precision, off-the-shelf Vlier products.



HEX NOSE SPEEDS INSTALLATION OF SPRING PLUNGERS—Vlier Hexnose Spring Plungers are easily installed with a simple end wrench. Eliminates hunting for special wrenches. Made to same exacting tolerances as Vlier Standard Spring Plungers. Available in many end pressures, diameters and lengths.



THIN-WALLED RING GEAR HELD SECURELY in fixture without distortion with 12 Vlier Torque Thumb Screws. Once pre-set end pressure is reached, knurled head spins freely, preventing overtightening. Checknut prevents backing off under vibration. Available in four types; various screw diameters and lengths.



NEW PLUNGER ASSEMBLY PREVENTS DAMAGE TO DIE STOPS—Plunger actuates automatic stop perfectly. Quickly installed, never needs adjustment. Hex nose mates with standard hex head bolts for easy insertion. Nylok® nylon pellet prevents threaded retainer from working loose. 6 sizes from ¼" to 1" diameter. Various end pressures.

FREE IDEA BOOKLET—Illustrations in this 16-page booklet show how others have profited from the use of Vlier Tooling Accessories. Shows both the usual and unusual applications. May suggest ways *you* can save. Write for your copy today.

VLIER
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"On the Button"...

DIAMETERS
18"
24"
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Number of stations to suit your requirements

PDC-JIC SERIES
"AUTOMATIC"
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YOUR CHOICE
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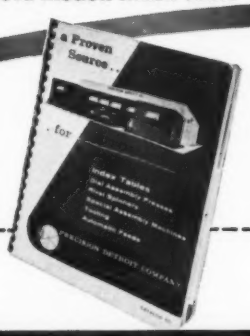

Write TODAY for new Catalog 60, for designers and engineers

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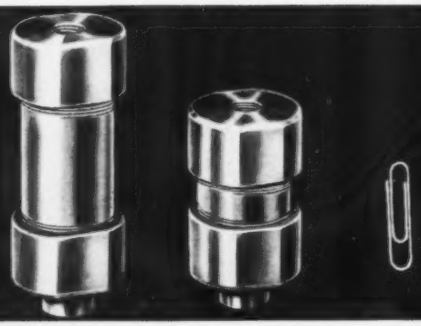
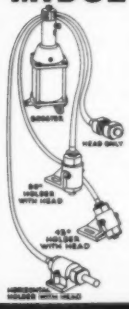
BIG GRIP FOR TIGHT PLACES!



with Wilton's NEW
MIDGET air-hydraulic PowRlock!



Holding problem in a machine operation where clearances are critical? The new Midget PowRlock is your answer. Although the Midget is smaller than a pack of cigarettes, it develops holding forces up to 1900 pounds! Securely holds and positions regular or irregular pieces. Four 1" or eight ½" stroke heads may be operated from a single booster.

WILTON TP-41

WILTON TOOL MFG. CO. INC. / SCHILLER PARK, ILL.

Attach this ad to your letterhead and mail for free literature!

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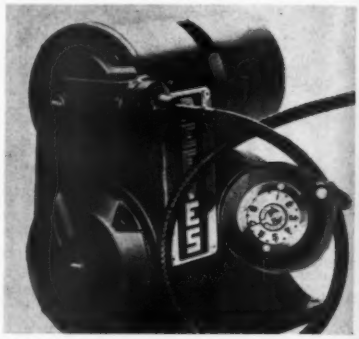
Product News

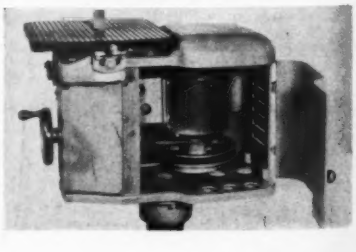
Mechanical Remote Control



A mechanical remote control for changing output speeds on Reeves variable speed Motodrives has been developed by Reeves Pulley Div., Reliance Electric & Engineering Co., 24701 Euclid Ave., Cleveland 17, Ohio. An indicator handwheel is turned to change speeds, and a flexible shaft connects the handwheel to the Motodrive. The shaft control is available for use on ¼ through 2-hp Motodrives. The remote control can be specified on new units, and kits are available for converting existing ones. Circle Inform-A-Gram No. P30.

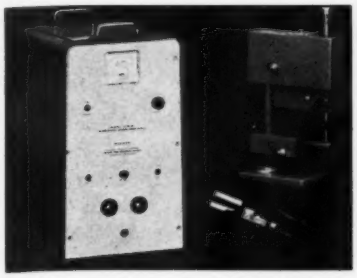
Profile Grinders

Grinding of die clearances, cams and contours, plus various finish-grinding work is within the scope of the new profile grinders from Rice Pump & Machine Co., Belgium, Wis. New features include hinged access door for easier maintenance, a large serrated table (12 x 13½") with improved U-bracket support and four way tilt. Spindle speeds available are 20,000, 30,000 and 35,000 rpm for single speed machines, 20,000 to 30,000 and 30,000 to 35,000 rpm ranges for double speed. Standard equipment is ½-hp 3450 rpm motor, or ¾-hp optionals. Basically bench-type these grinders can be mounted on pedestal or four-legged floor stand. Write the manufacturer, or circle Inform-A-Gram No. P31.



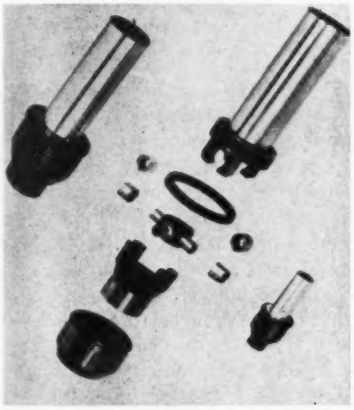
Something for Everybody

Everybody who welds thin metals, that is. Shown is only one of the six power supplies and one of the five weld heads and handpieces, designed and manufactured by Hughes Aircraft Co., 2020 Short St., Oceanside, Calif. Manufacturers of relays, tubes, transducers,

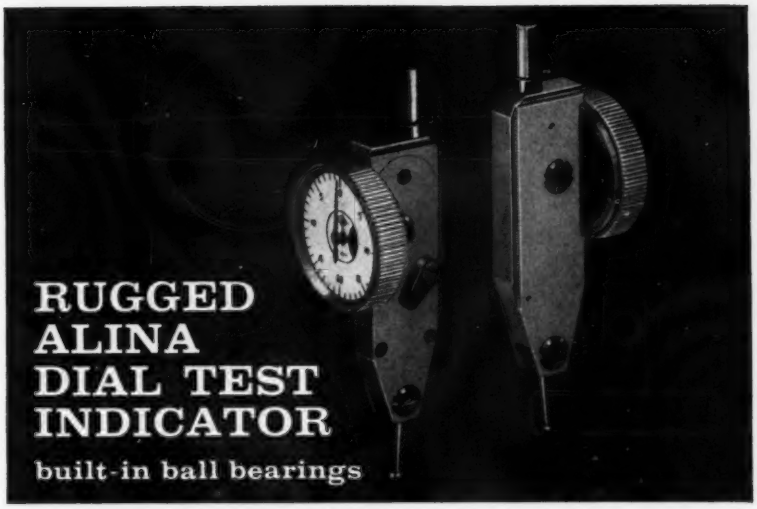


thermocouples, and high density component packages, have adopted electronic welding for many assemblies. It's said to produce reliable joints that withstand shock, elevated temperatures, and severe environmental strains. Write the company, or circle Inform-A-Gram No. P32.

Floating Toolholder



Aline-X, a floating toolholder, is to compensate for the inaccuracies of misalignment from spindles to workpiece. In shank sizes from ⅝ through 1½", and fitting any standard single or multiple spindle screw machine or turret lathe, it is made by Allied Metal Products, Inc., 1082 Farmington Ave., Kensington, Conn. In precision reaming and boring operations, the toolholder is credited with eliminating bellmouthing, oversizing, and scoring. It has nine parts and a single accurate adjustment point. Write the manufacturer, or circle Inform-A-Gram No. P33.



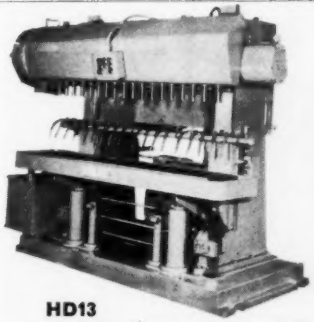
for greater sensitivity—reduced pressure—improved accuracy

- Jeweled • Shock Proof • Range .032" • Graduated .0001"
- Reading 0-20-0 • Fully reversible contact point
- *Holder attaches to stem or to integral dove tails on body*

Available with a wide variety of rectangular or round shanks.

The instrument shown here is part of a complete line of precision DIAL TEST INDICATORS of all types — Write for brochure!

ALINA CORPORATION
122 East Second St., Mineola, L. I., N. Y.
CIRCLE INFORM-A-GRAM KEY NO. 1111

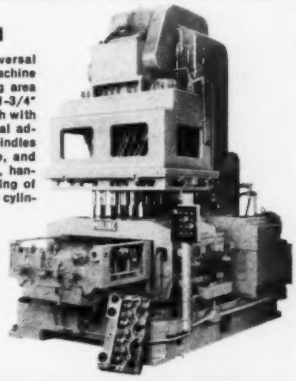


HD13

straight line drilling machine with hydraulic table feed and 18 spindles each having 11/16" diameter drill capacity in mild steel. Spindle center distances are adjustable along the 6-foot machine rail.

MODEL HU111

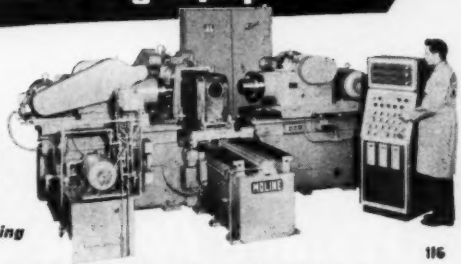
Hydraulic Feed, Universal Joint-Type Drilling Machine with 24" x 50" drilling area and with forty-two 1-3/4" spindle drivers, each with two-speed and neutral adjustment. Thirty-six spindles in slip spindle plate, and power shifting fixture, handle drilling and reaming of three different engine cylinder heads.



MOLINE Cost Reducing Equipment

MODEL MR148

Three-way, three-spindle, horizontal boring machine with selective automatic feed cycle. Handles boring of cylinder and crank bore for 3 sizes of 1-cylinder blocks. Also bores for wet sleeves in 2- and 3-cylinder blocks.



60 years of Machine Tool Engineering Experience is at your service for

116

- Multi-Spindle Boring • Single and Multi-Spindle Honing
- Straight Line Multi-Drilling • Adjustable Spindle Drilling
- Special Multiple Operation Machine Tools

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100 20TH STREET • MOLINE, ILLINOIS
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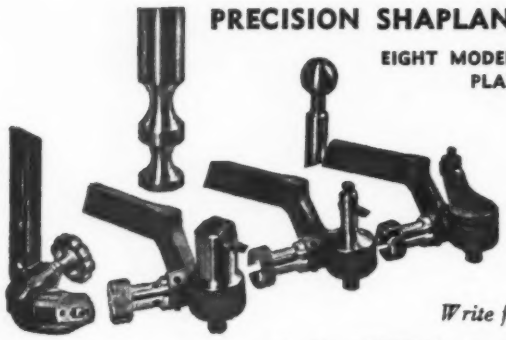
REPRESENTATIVES IN PRINCIPAL CITIES



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EIGHT MODELS FOR LATHES, SHAPERS, PLANERS AND BORING MILLS

Range: 3/8" to 3" for concave radii on lathes. Two sizes for convex radii (Balls up to 2½" dia.) on lathes. Also heavy duty model for radii to 6" on planers, etc.

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Patent Pending

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Entirely new concept-layouts up to 8 times faster.
Lays out workpieces on all four sides, top and bottom—checks inside surfaces with one setting of casting or workpiece.
No special training needed . . . experienced layout man can learn to operate this machine efficiently in about 30 minutes.
*Patent Pending
LINEAR FEATURE
adds 3rd dimension—controls or measures linear movement of machine.
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ASTE Show . . . Booth No. 3063

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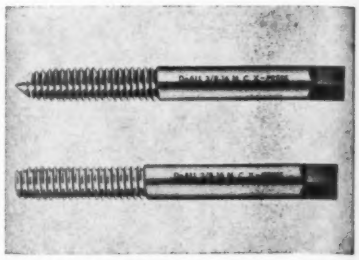
Product News

New Concept in Tapping



X-Press taps present a new concept in tapping by forging instead of cutting internal threads in copper, brass, zinc, lead, aluminum, die castings and other ductile materials. The new taps are available from DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill. Used like conventional taps, X-Press taps work at faster spindle speeds. By forging instead of cutting threads, there are no chips to clog flutes or break the tool. Standard sizes range from #0-80 through ½" dia. Write the manufacturer, or circle Inform-A-Gram No. P34.

Pedestal Belt Grinder

The work table of a new heavy duty abrasive belt grinder is adjustable eight ways. For angular and compound angular applications, the table raises, lowers and tilts to the right, left, up or down. It can be moved toward belt and platen or retracted. Roller, flat and contoured platens are optional. It's equipped with a 3-hp motor, automatic constant belt tension head and quick belt changing release. Abrasive belt capacity is 5 x 132". Belt speeds range from 1200 to 3800 sfm for wet or dry applications. Write Bush Mfg. Co., 900 Rochester Rd., Clawson, Mich., or circle Inform-A-Gram No. P-35.

MAGNETIC BASE TOOL HOLDER | **21 MAGNETIC TOOLS** | 11 PERMANENT MAGNETS—VARIOUS SIZES AND TYPES

Indicator Holder - 1/4" dia. non-magnetic stainless steel rod complete with 5/16" and 3/8" O. D. bushings. Fine precision adjustment identical to surface gage. Hardened ball socket setting permits universal positioning. Powerful 50-lb. pull magnetic base insures firm grip on any ferrous surfaces curved or flat.

Model 200B-$6.95

Write for Catalog No. 958-B

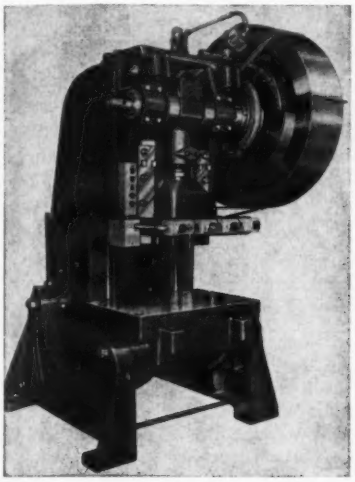
CULLEN MFG. CO., INC.
1603 Washington Ave., Racine, Wis.

CIRCLE INFORM-A-GRAM KEY NO. 1123

Product News

For Big and Small Jobs

A press that handles both large and small jobs easily and quickly is Model 70 Press-Rite. With maximum ram rigidity and low deflection, the press features high tensile, semi-steel frames and exclusive built-in tie rods. Minimal binding and misaligning of dies during heavy blanking and drawing is said to increase die life up to 50% over conventional OBI presses. A ram with extra large



face area handles heavy and small jobs with equal dexterity. An automatic cam actuated brake, a minimum flywheel drag and anti-friction bearings in the flywheel are other plusses. The Model 70 is also available in airflex air friction clutch with air-applied brake and back geared models from Havir Mfg. Co., 444 Cleveland Ave., St. Paul, Minn. Circle Inform-A-Gram No. P36.

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MICROMETER
INDICATOR
REPAIRING
EVERY MICROMETER SATIN CHROME FINISHED AT NO EXTRA CHARGE
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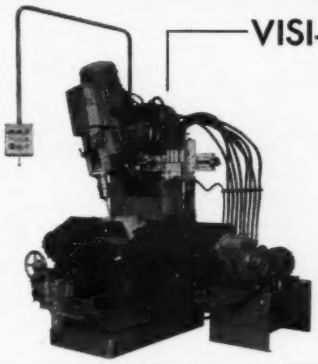
VISI-TROL



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SWIVEL MILL
WITH
SELF CONTAINED HEAD

HEAD AND TABLE
TILT 45° EACH SIDE
FROM CENTER

VISI-TROL ENGINEERING CO.
12720 BURT RD. DETROIT 23, MICHIGAN

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For { 8-STATION PRODUCTION MACHINING
1½" BAR AND COLLET WORK
CHUCKING
SINGLE POINT THREADING

Costs { $7,167.00 FOB Factory Complete with all standard equipment

This is an all new 1½" bar capacity ram type turret lathe with power feeds to all 8 working stations . . . that in addition to bar and collet work also has the versatility to do chucking, and when needed, single point threading. Powered by a 5 h.p., two-speed, geared motor, the new Sheldon 3 R turret lathe provides 16 spindle speeds, 60 different feeds to the carriage and cross-slide, and 180 different feeds to the ram turret.
The turret itself is ruggedly built and accurately machined to provide close tolerance indexing. And for complete ease of operation, it is put under power by simply pressing a push button on the control panel.

This new 3 R Sheldon is completely equipped with two-speed motor and electrical controls, coolant system and splash guards, LO spindle nose, large satin chrome dials and hardened bed ways. It also provides an additional cost saving feature—each turret face is drilled and tapped for your standard flange type tooling as well as being bored for your standard 1½" shank type tooling.
For versatile, accurate machining in either long or short runs, the new Sheldon 3 R provides the answer to low investment cost with high profit operation.

New SHELDON
3R-TURRET LATHE

Write for bulletin with complete specifications and tooling data

SHELDON MACHINE CO., INC.
4235 N. KNOX AVE. • CHICAGO 41, ILL.

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BRAND NEW!

SANFORD MG GRINDER and DUST COLLECTOR in a SINGLE COMPACT UNIT

MG GRINDER ALSO AVAILABLE FOR DRY OR WET GRINDING *WITHOUT DUST COLLECTOR*

The most widely used precision machine for unit grinding. Famous for its unsurpassed workmanship, quality and vibration-less operation. The MG is the grinder that's been "copied" but never equaled.

A COMPLETE DUST COLLECTOR INCORPORATED INTO GRINDER STAND.

- Exclusive design exhaust hood catches all sparks.
- Can be wired to grinder starter.
- Uses standard size filters—renewable or disposable type, or a combination of both.
- No outside exhaust needed.
- Saves floor space.
- Full size rear door gives access for cleanout.

PARTIAL SPECIFICATIONS

GRINDER: CAPACITY — 8" x 12" x 12". TABLE TRAVEL — 13", TRAVERSE 8¾". VERTICAL CLEARANCE — 12" under 7" wheel. STANDARD GRINDING WHEEL —7" x ½" x 1¼" hole. SPINDLE SPEED — 3000 RPM. MOTOR—½ HP, single or 3 phase TEBB dynamically balanced. FLOOR SPACE — 45" x 38", 62" high on floor stand. NET WEIGHT — 600 lbs.

DUST COLLECTOR: BUILT INTO GRINDER FLOOR STAND. EXHAUST CAPACITY—650 CFM. MOTOR — ½ HP, 3450 RPM, single or 3 phase. NET WEIGHT — 140 lbs.

SANFORD MANUFACTURING CORP.

1024 Commerce Ave., Union, N.J.

CIRCLE INFORM-A-GRAM KEY NO. 1141

Product News

Big and Little Bores

Now even hardest grades of carbide cutting edges — ones that can't be brazed — can be handled with a new toolholding system. Made by DeVlieg Machine Co., Royal Oak, Mich., the system stems from the company's Microbore unit and holds a full range of disposable, extremely hard carbide cutting inserts. Built into the cartridge is the Microbore micrometer-vernier which provides rigidity for heavy cuts. It also seats the insert firmly and allows precise adjustment. Type S for general precision boring in smaller hole sizes, including $^{15}/_{16}$" dia, uses the button head screw seating principle. Type C using clamp-on shim, chipbreaker and insert release is aimed at large bore sizes for light, medium and heavy machining. More on both from the manufacturer, or circle Inform-A-Gram No. P37.

NEW LOW COST PRECISION VERNIER CALIPER

The new Titan No. 244 Vernier Calipers offers all of the features usually found only in instruments costing much more. Constructed entirely of Satin Finished Stainless Steel it features inside and outside jaws which start at 0. The inner jaws are undercut to simplify groove measurement. Its double length vernier is easier to read—its knurled fine adjustment is easier to operate. 0-6" scale including depth rod. Guaranteed accuracy up to 0.001". All measuring surfaces are hardened and lapped for continued accuracy. Now only $17.75 including Plastic Case.

Dealer Inquiries Invited

TITAN TOOL SUPPLY COMPANY, Inc.

Box L—1419 Hertel Avenue

Buffalo, New York

CIRCLE INFORM-A-GRAM KEY NO. 1142

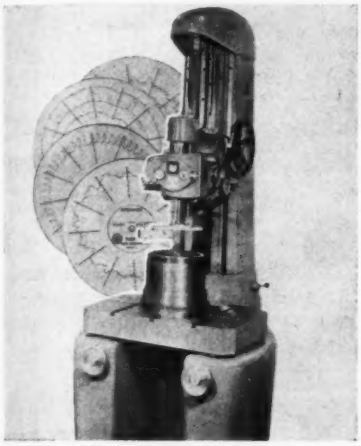
It Reads by Dead-Weight

The Cady dead-weight sheet stock thickness micrometer is now fitted with a vernier scale which permits direct readings of tenths from the one-thousandths dial graduations. Built by E. J. Cady & Co., 630 N. Harlem Ave., River Forest, Illinois, the micrometer, equipped with the vernier, brings the advantages of the gravity-descent anvil and larger thickness capacity (½") to the fields of critical measurement. Illustrated thickness reading is 0.0042, taken where graduations on both dial and vernier coincide. More information on the 8 lb psi micrometer from the manufacturer, or through Inform-A-Gram No. P38.

Product News

Measures Out-of-Round

The Talyrond roundness measuring instrument checks large units to 0.000001, according to Engis Equipment Co., Div. Engineering & Scientific Instrumentation, 431 S. Dearborn St., Chicago 5, Ill. Checking bearings, transmissions, crank shafts, compressors and all types of components for moving parts and bearing applications, the work table of Model 2 carries up



to 1000 lbs. The Talyrond inkless polar chart keeps a permanent record of roundness, concentricity, coaxiality, squareness and interrupted circular shapes. Test piece is fixed while measurements are made and electronically recorded. The rotating spindle of the Talyrond is not affected by size, balance or shape of work. Write Engis, or check Inform-A-Gram No. P39.

To Release or Not Release

A new group of tap holders may be used as either releasing, or non-releasing units. Usable on all machines with reversing spindles, they convert the machines into precision tappers. By employing the self-feed feature on these tools, one is assured gage perfect threads even when they're used for re-entry with finishing taps for tapping in two operations. There is said to be no thread distortion or double threading. Length of pull-out for releasing can be varied from a minimum of ⅛ to a maximum of ¾″ by adjusting the

knurled depth control collar. With tap capacities of ⅝, 1 and 1¼″ dia, the tap holders are made by Tapmatic Corp., 845 W. 16 St., Costa Mesa, Calif. Circle Inform-A-Gram No. P40.

UNBREAKABLE!

This is a punishing test for a hack saw blade. We do it to prove that a Marvel High-Speed-Edge Hack Saw Blade is unbreakable. A Marvel Blade can be bent like this thousands of times and it still won't break.

Why? Because the blade body—to which a high speed steel cutting edge is welded—is made of a tough, non-brittle alloy steel designed to take the heaviest feed pressures and highest speeds any modern hack sawing machine can develop.

What does this unbreakable feature of Marvel Blades mean to you?

1. Operators, knowing they can trust Marvel Blades not to break, tension them truly taut (from 200% to 300% more than ordinary blades) to produce maximum obtainable accuracy of saw cut.
2. They can safely apply heavier feed pressures and higher speeds without endangering themselves or the machine to produce faster cutting-off.
3. Longer cutting life is assured because the blade simply won't break.

Ask for Marvel High-Speed-Edge Hack Saw Blades by name and you can be sure you're getting the unbreakable blades designed to give you maximum accuracy, speed, and safety in your cutting-off operations. Leading Industrial Distributors have Marvel Blades in stock.

MARVEL Metal Cutting SAWS BETTER MACHINES BETTER BLADES

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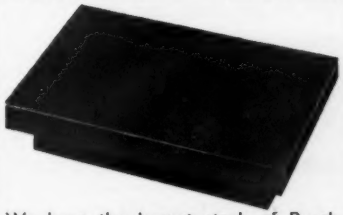
CIRCLE INFORM-A-GRAM KEY NO. 1151

BLACK GRANITE SURFACE PLATES



We have the largest stock of Busch precision Granite Surface Plates, available for fast delivery, in the midwest. Choice of 4, 2 or no ledge styles. Write for free brochure and price list.

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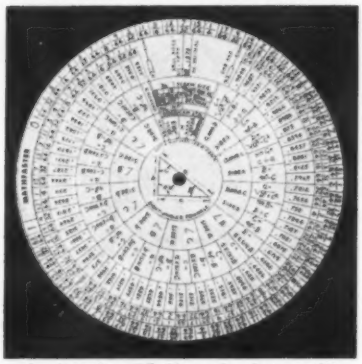
CIRCLE INFORM-A-GRAM KEY NO. 1152

Product News

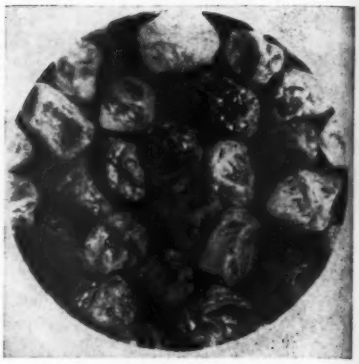
Calculations in the Round



A circular 7" dia calculator eliminates wall charts, handbooks and data sheets, and performs rapid addition or subtraction of fractions. Made by Pierce Mathfaster Calculator, Box 837, Arleta, Calif., and priced at $1.00, the calculator comes with its own instruction booklet. It also supplies decimal equivalents of fractions, illustrated dimensions of round, flat, socket, or fillister head screws and nuts, tap drills and decimal size of both letter and number drills, diagrammed formulas for solutions to triangles and areas or volume of circles, trapezoids, cones, etc.

Natural Diamond Grit

Lauded as one of the most important developments in natural diamonds is the new "pressure tested" diamond grit. These new diamond particles promise long life and efficiency in grinding wheels or saws, or other operations where heavy cutting or grinding pressures are essential. Diamond Tool Research Co., Inc., 580 Fifth Ave., New York 36, N.Y., has pre-tested the diamond abrasive. Extreme pressures break the rough diamonds into sound, blocky grits. Flats and pieces with severe internal stresses are subjected to



pressures that break them again and again until only sturdy grains result. For more complete data write the researchers, or check Inform-A-Gram No. P41.

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Here's the inexpensive, fast way of molding and remolding your own lead hammers with this COOK mold and ladle. It produces hammers that can "take it" Simple to operate.

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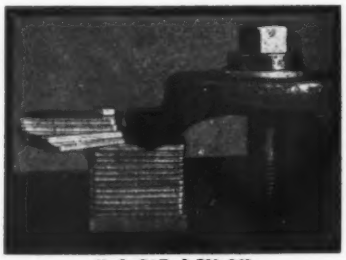
NEW!

HANDY ADJUSTABLE

RISER BLOCKS



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- Cost only $7.50 per pair; $75.00 per 12 pairs, plus transportation costs. Shipping weight 3 lbs. 10 oz. per pair.

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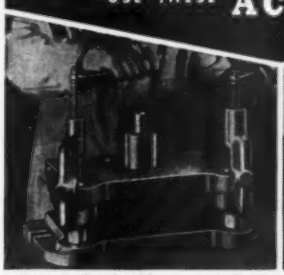
FOR EASY, FAST UNIFORM SEPARATION OF DIE SETS...
USE THESE **ACRO** PULLERS



Separate die sets with even upward pull.

Die sets separate evenly and safely.

When you have die set pullers that remove the punch holder from the die shoe by a straight upward pull and the punch holder slides upward from the die shoe simultaneously and safely from both leader pins, you have Acro Die Set Pullers and you're saving time.

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by ANTONI NIEDZWIEDZKI
Machining Consultant

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- Drill most materials—aluminum, cast iron, brass, tool steel, stainless, etc.
- Drill any shaped part to any depth (sometimes interrupted holes or across existing holes).
- Drill shallow or deep holes to precision tolerances.

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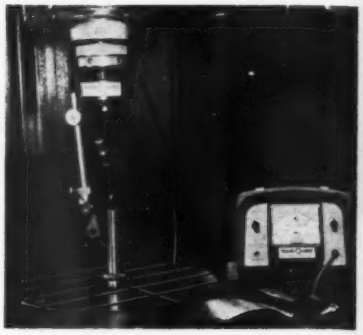
CIRCLE INFORM-A-GRAM KEY NO. 1172

Product News

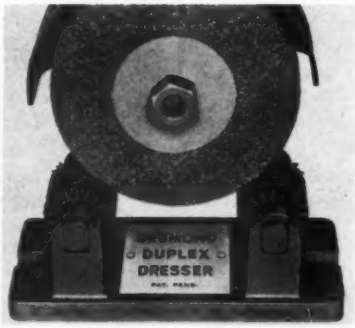
Dead Center

For accurate positioning and aligning of work on machine table, for checking spindle runout, roundness, bellmouth, concentricity and center-to-center distances, Trans-O-Limit will do the job. Credited with accuracy to 1% of full scale and 2½ millionths is the high magnification scale, the centering gage is made by Pratt & Whitney Co., Inc., West Hartford, Conn. The instrument consists of a height gage head, slip-ring assembly, gage head support arm and interchangeable arbors for different mountings. Adjustable, the gage has a radial capacity of 23″ ID and 19″ OD, and a depth of 8⅜ to 15⅛″ depending on configuration of the part. Circle P42.



Duplex Dresser

A new grinding wheel dresser with a double cutter unit is designed for dressing and truing straight-faced grinding wheels used on flexible shaft and portable grinders. The unit dresses wheels from 4 to 8″ dia without removing them from their spindle. The revolving grinding wheel is cradled between the cutter units for a few seconds and the face of the wheel is dressed straight, load is removed and original fast cutting action restored. The dresser is 2¾″ high, with a 7″ long by 3¼″ wide base, and weighs 6 lbs. Mountable on a bench or any flat surface, the wheel is manufactured by Desmond-Stephan Mfg. Co., Urbana, Ohio. Circle Inform-A-Gram No. P43.



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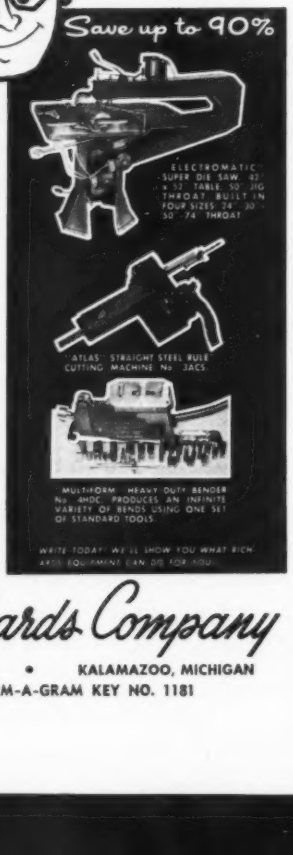

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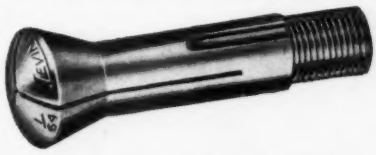

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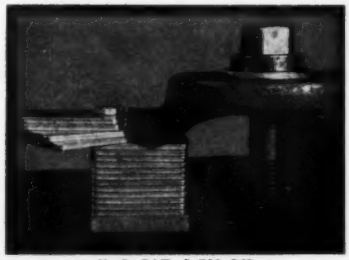

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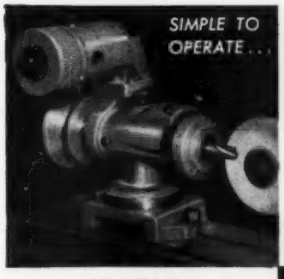

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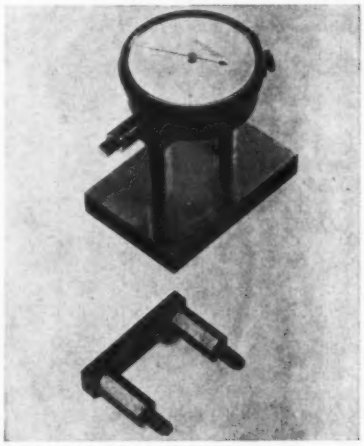

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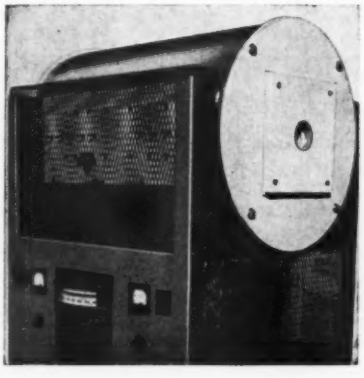

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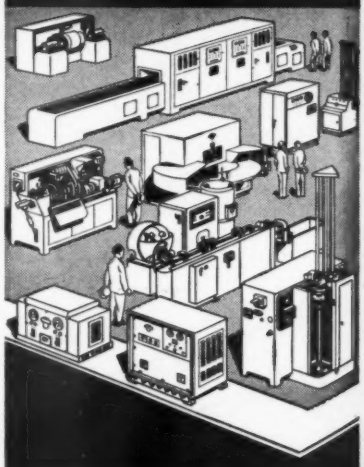

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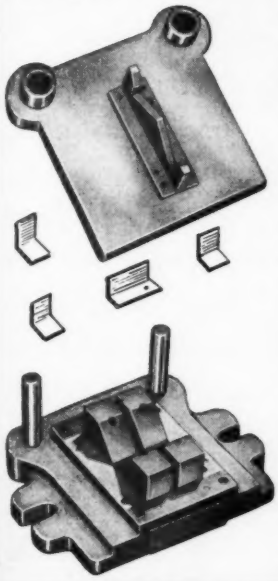

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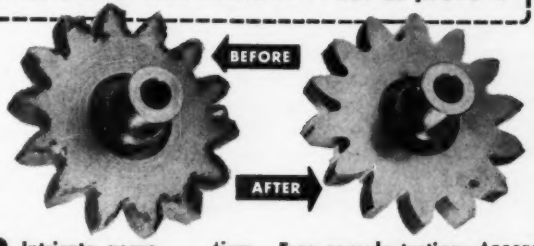

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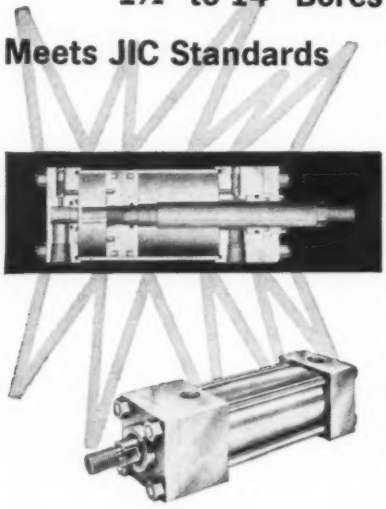

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4	4-6-8-10-12-16
4-1/8	4-8-10-12-16
4-1/4	4-8-10-12-16

Many more sizes in stock up to 6" dia.

LEFT HAND N.C. (USS)—N.F. (SAE) SIZES

SEE ABOVE SECTION FOR MORE SIZES

SIZE	THREADS	SIZE	THREADS	SIZE	THREADS	SIZE	THREADS
0	80	8	32-36	7/16	14-20	1"	8-12-14
1	64-72	10	24-32	1/2	13-20	1-1/8	7-12
2	56-64	12	24-28	9/16	12-18	1-1/4	7-12
3	48-56	14	20-24	5/8	11-18	1-5/16	6-12
4	36-40-48	1/4	20-28	11/16	11-16	1-3/8	6-12
5	40-44	5/16	18-24	3/4	10-16	1-7/16	6-12
6	32-40	3/8	16-24	7/8	9-14	1-1/2	6-12

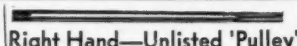
'OVERSIZE' and 'UNDERSIZE' TAPS

RIGHT AND LEFT HAND N.C. AND N.F. SIZES

MACHINE SCREW	#2 to #5	Plus or Minus	.002, .003, .005
MACHINE SCREW	#6 to #14	Plus or Minus	.003, .005, .010
FRACTIONAL	1/4" to 1-1/2"	Plus or Minus	.003, .005, .010, .015, 1/64, 1/32

Right & Left Hand—Unlisted 'Gun' or Spiral Pointed Taps

Size	Threads	Size	Threads
0	80 NF		
1	56 NS	7/8	9 NC, 14 NF
2	56 NC, 64 NF	1	8 NC, 12-14 NF
9/16	12 NC, 18 NF	1-1/8	7 NC, 12 NF
5/8	11 NC, 18 NF	1-1/4	7 NC, 12 NF
11/16	11 NS, 16 NS	1-3/8	6 NC, 12 NF
3/4	10 NC, 16 NF	1-1/2	6 NC, 12 NF



Right Hand—Unlisted 'Pulley' And Extra Length Taps

Size	Threads	Size	Threads
4	36-40 NC, 48 NF	3/8	24-NF
5	40 NC, 44 NF	7/16	20 NF
6	32 NC, 40 NF	1/2	20 NF
8	32 NC, 36 NF	9/16	12 NC
10	24 NC, 32 NF	9/16	18 NF
12	24 NC, 28 NF	5/8	18 NF
1/4	28 NF	3/4	16 NF
5/16	24-NF	Also Larger Sizes	NC & NF

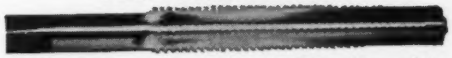
UNLISTED Right Hand "Pipe" Taps

"NPT" Taper	"NPT" Thread	"NPS" Size	"NPS" Thread	EX. LENGTHS "NPT" & "NPS" Size	EX. LENGTHS "NPT" & "NPS" Thread
1/16	27	1/16	27	1/16	27
1/4	27	1	8	1/8	27
2-1/2	8	1-1/4	11½	1/4	18
3	8	1-1/2	11½	3/8	18
3-1/2	8	2	11½	1/2	14
4	8	2-1/2	8	3/4	14
Also British		3	8	1	11½
		3-1/2	8	Also British	
		4	8		
		Also British			

Left Hand 'Pipe Taps' Taper and Straight

Size	Thread	Size	Thread
1/16	27	1	11½
1/8	27	1-1/4	11½
1/4	18	1-1/2	11½
3/8	18	2	11½
1/2	14	2-1/2	8
3/4	14	3	8
Also British		3-1/2	8
		Also British	

ACME TAPS IN STOCK



IF NOT IN STOCK — 7 to 10 DAYS DELIVERY — When ordering or requesting quotations, kindly furnish following information:

(a) Kind of material being machined. (b) Depth of hole in inches, through or bottom. (c) Tap to be used horizontally or vertically. (d) Will tap turn, or is piece expected to be turned. (e) Is tapping job expected to be done in one pass. (f) Would tap be backed out of hole, or machine stopped for release of tap. (g) If possible, submit thread length, and overall length of tap desired with blue print.

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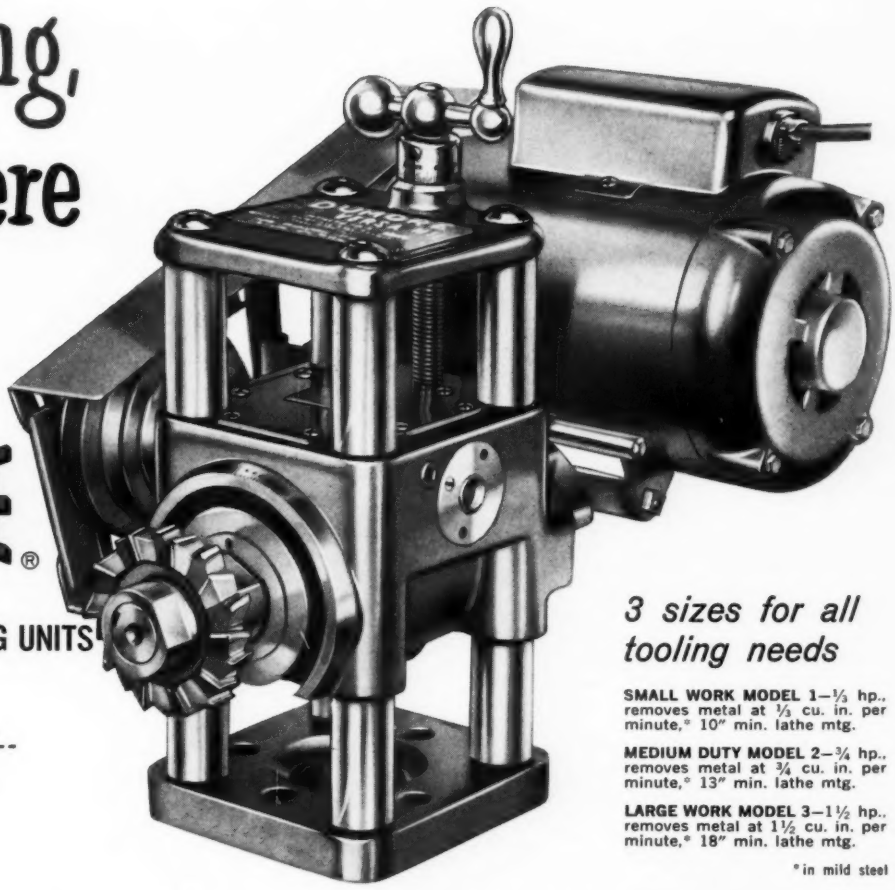

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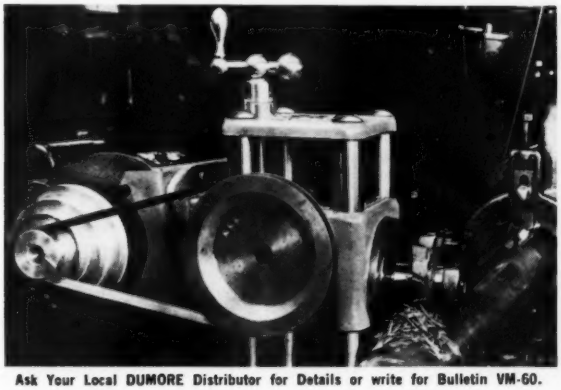

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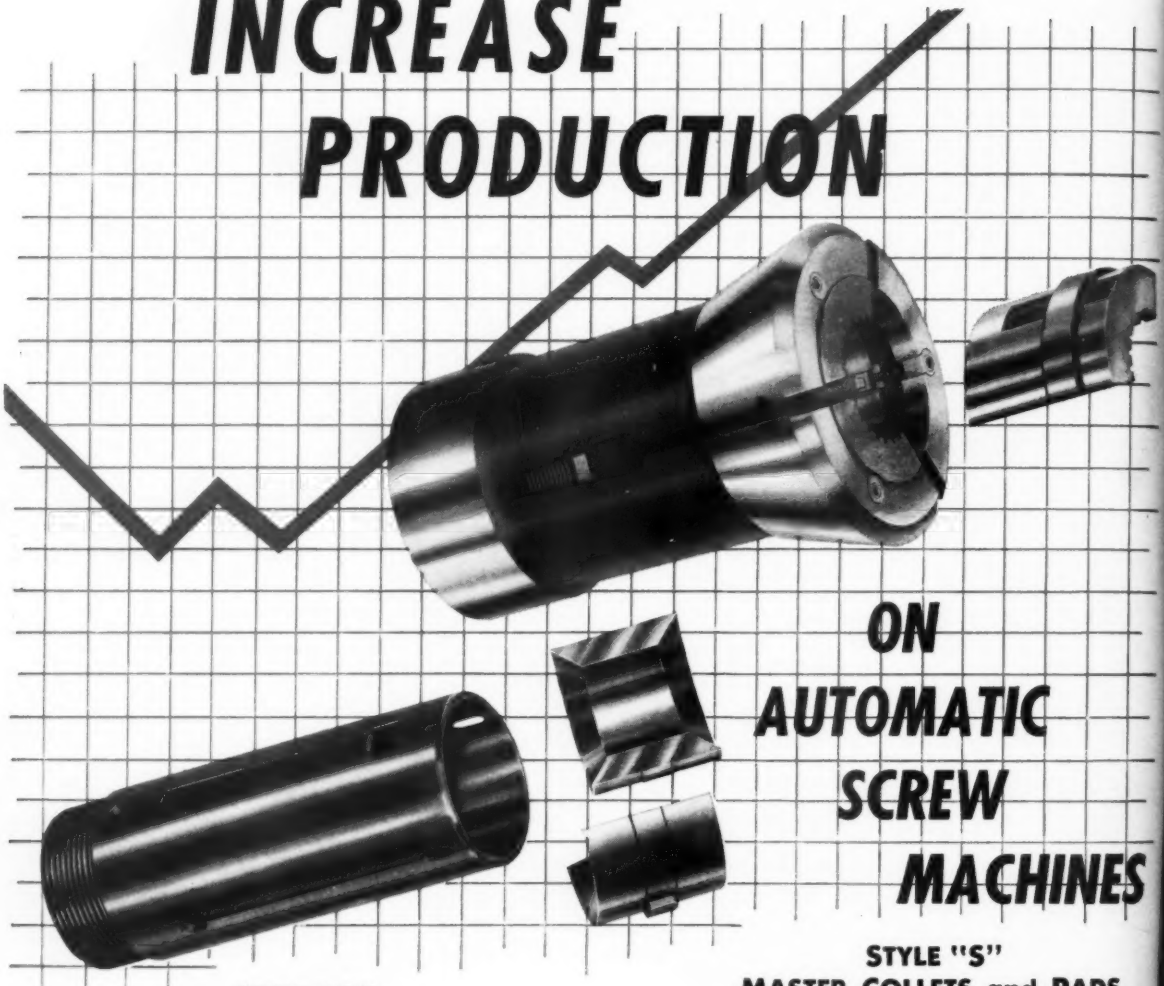

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